

August 21, 1961

Aviation Week

and *Space Technology*

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Antenna Arrays
Are Developed

Haystack Hill Radome



ANOTHER ASPECT OF THE MARQUARDT MISSION



ELECTRIC PROPULSION

Sustained space travel, free from gravitation is a natural vacuum, presents new and difficult problems in the propulsion and control of space vehicles. Electric propulsion presents a practical and economical means of accomplishing space exploration programs.

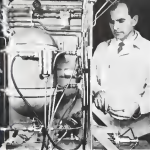
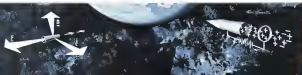
The three main types of electric engines, while varying in performance specifications, share common advantages over chemical engines. The electrothermal, electromagnetic, and electrodeless engines offer specific impulses greater than 1,000 seconds and thrust densities measured in volts to pounds. As a result, electric propulsion systems have the capacity to deliver much longer payloads over longer distances than will conventional rockets. Power for these electric engines can be drawn either from radioisotope energy sources built into the vehicle or from solar radiation.

The Marquardt Corporation—long a leader in the field of propulsion—is continuously engaged in a variety of unique electric propulsion projects. An example is the electrodeless arc in the Linacjet. Here the hydrogen propellant passes over an electrically heated resistance element prior to

expansion in a deLaval nozzle. The Linacjet provides reliability, long life, direct coupling to the power supply, high efficiency, a simple starting cycle, and thrustability. The Marquardt Corporation's efforts in the space propulsion and control fields serve to typify yet another aspect of the Marquardt Mission.

Creative engineers and scientists are needed. All qualified applicants will receive consideration regardless of race, creed, color, or national origin.

THE Marquardt CORPORATION
CORPORATE OFFICES, VAN NUTS, CALIFORNIA



Special test facilities designed by Vickers Research and Development units are used to evaluate nozzle designs, fuels, controls, instrumentation, etc. This setup is used in hypergolic bipropellant studies.

CAPABILITY is spelled a-t-t-i-t-u-d-e c-o-n-t-r-o-l

Selection of the optimum attitude control system for a particular missile or space vehicle requires special technical skills, facilities for conducting the necessary test programs, and knowledge widely based on related experience. All these are available "on quantity" at Vickers.

Actual experience dates back to ball gas servo studies initiated in 1955 and now covers the additional areas of hydrogen peroxide-powered reaction control, hypergolic bipropellants and secondary injection systems using either liquid (liquid), or hot gas bleed from engine combustion chambers.

The facilities and skills responsible for these developments in attitude controls are available to you as a vital aid in solving the problems of space-flight orientation. For more details, write for Bulletin A-5264, and/or call the Vickers' Application Engineer in your area. He is a thoroughly experienced practitioner in the "Programmed Power" field.



Nozzle designed for hypergolic bipropellant shown under test. Flame temperature 3500°K. Exhaust flow is characterized by well defined series of shock diamonds.



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Space vehicle simulator used in development of attitude control systems weighs 2 tons, yet can be set in motion with a finger touch. Entire unit is supported on a 3-inch steel ball that floats on a hydrostatic bearing and is free to move in three planes—pitch, yaw and roll.



NEW NAVY... NEW WEAPONS



New naval defense concepts are vital in these days of nuclear submarines and guided missiles. One of these: A destroyer class hydrofoil boat guided to landing every submarine by remote-controlled Ford Instruments is now waiting to turn this new concept into operational hardware... one of the most recent efforts in over 40 years of service to all branches of the armed forces.



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1-4

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Min-K, the unique insulating material developed and produced by Johns-Manville, now has an added quality—flexibility! Min-K is a new concept in insulate materials. The higher it flex, the better it insulates. Min-K's thermal conductivity drops as atmospheric pressure decreases. Its extreme performance has been proved in hundreds of optional U.S. missiles.

New Flexible Min-K offers many special advantages. For example, it is the ideal way to keep in shape easy. You can test performance without the expense of special testing. The flexible blankets themselves to bending, insulation with reinforced plastics, service coatings and as a component of insulation systems. Further, Min-K can be in flat-sheets to wrap or erect a cylinder, cone or other geometric shape. And, it is also available in 1", 2" and 3" tapes for special wrapping on a duct or pipe.

Because of the added quality of flexibility Min-K's unique insulating characteristics now can be used in virtually unlimited new applications. For full details on Flexible Min-K, Min-K and other J-M aviation insulations, write Johns-Manville, Box 14, New York 16, New York. In Canada: Port Credit, Ontario. Cable address: Johnsons.

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1950

FIRST successful intercept of piston aircraft by guided missile...Raytheon's Lark.



1956

FIRST successful intercept of jet aircraft by guided missile...Raytheon's Hawk.



1960

FIRST successful missile-to-missile intercept...Raytheon's Hawk.



Artist's conception of the ballistic missile challenge.

Raytheon brings proven capability to the

Defense against ballistic missiles is one of today's most challenging technological problems. Raytheon, since its development of Lark in 1950, and its participation in 1954 in the Wizard studies, has been working on a broad technological front in the development of systems concepts and equipments for de-

fense against missiles and aircraft.

The development and production by Raytheon, as prime contractor, of the U.S. Army and Marine Corps Hawk, and the U.S. Navy's Sparrow III missile systems, are part of this broad spectrum of defense system capability. Allied programs include study of

challenge of ballistic missile defense

Field Army Ballistic Missile Defense, development of the PINCUSHION and COSAR Advanced Radar Systems, and responsibility as Systems Manager for the ARPAT Missile Defense Research Program.

One of the world's largest scientific-industrial organizations, Raytheon has the proven

capability to create the required technology and manage every phase of a complex system — from early study and design through development, production and field support of operational systems and equipment. *Executive Offices, Lexington 78, Massachusetts.*

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MISSILE AND SPACE DIVISION

RAYTHEON

To
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NASA
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on
the
moon...
requires
Motorola
systems
reliability

GALILEO'S JPL RANGER,

to carry research instrument packages to the moon, will rely upon precision design, construction, testing and performance of Motorola electronic equipment. Components or measurements of operational and navigational data aboard will be assembled for transmission by its Flight Data Recorder. An all solid state Transponder generates the telemetry carrier, receives ground commands, and translates carrier frequencies for two-way Doppler velocity measurements. In laboratories and at launch site, Payload Test Beta will check out the spacecraft RF communications system. At NASA's transmitter and receiver sites, Calibration Beacons will check connected transmitter performance and relate precise signals to test telemetry receivers. Motorola's participation in Ranger lunar probe demonstrates its space communications capabilities for frontier programs.

Military Electronics Division



MOTOROLA

Qualified technical personnel are invited to apply

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RYAN RESEARCH VEHICLE SPEARHEADS FLEX WING APPLICATIONS



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With the world's first manned Flex Wing vehicle, Ryan engineers are uncovering valuable new flight data which will adapt this concept to a broad variety of important military and space applications.

Necessity of huge boosters, nose cones and capsules... are entry of space vehicles at reduced velocities... helicopter tow of lightweight payloads... controlled delivery of air-dropped cargoes to "pin-point" landings... small reconnaissance drones to meet combat needs. These

are a few of the multiple applications for which the Flex Wing can be used.

Based on a National Aeronautics and Space Administration concept, the Flex Wing provides greater lift per weight than fixed wings, is superior in inherent stability and can be precision-controlled in both powered and unpowered versions. It can be packaged into an extremely small volume and then deployed faster than any other decontamination or lifting device.

Ryan has received several contracts from NASA and the military services to explore and develop the more promising Flex Wing applications. Possessing an entirely new concept, such as Flex Wing, is typical of Ryan's Space Age capabilities.

Ryan Aerospace—Ryan Aeronautical Company, San Diego, California.

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The Steel Products Engineering Division of Kelsey-Hayes is developing the radar antenna mounts for Bell Aerosystems' All-Weather Automatic Landing System. Designated AN-SPN-10 by the Navy, the system has been selected for use aboard the USS Enterprise and other nuclear-powered carriers.



Since 1944, Space has been a vital force in the nation's aviation and defense programs... and since 1948, has provided radar components for 14th Fleet, Nike Hercules, Nike Zeus and many other portable systems. For further information write: Space Division, Kelsey-Hayes Co., Springfield, Ohio.

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The NASA-AT&T Contract

National Aeronautics and Space Administration has signed a highly unusual agreement with the American Telephone & Telegraph Co. for the launching of experimental communications satellites. Because of the great interest this has aroused in government and in the communications and aerospace industries, *Aerospace* writes a publishing the story in our recent issue recently by NASA Administrator James E. Webb before the House Science and Astronautics Committee, which is the most comprehensive legislation of the industry behind the contract that has been given by the government to date.

When I appeared before this committee earlier to discuss the work of the National Aeronautics and Space Administration in the field of communications satellites, we had just at the time concluded a cooperative agreement with American Telephone & Telegraph Co. We have now done so, and I am therefore able to discuss that agreement with you.

The American Telephone & Telegraph Co. will design and build communications satellites, at its own expense, for two launches during 1962. NASA will provide the launch vehicles and the facilities for launching and tracking and will be reimbursed by AT&T.

These arrangements with AT&T will add greatly to the total program of experiments in active satellite communications and will assist in the development of relationships between government and industry which are necessary to accelerate the early realization of an operational system.

The agreement with AT&T has been made in a manner which will avoid putting AT&T in a preferential position in relation to other interested companies, which may, in the future, have an interest in the operation of a communications satellite system or supplying equipment to the operator of such a system.

In the first place, the project is recognized by both parties as entirely experimental. This means that it does not involve any commitment with respect to any operational undertaking or any particular design of operational satellites.

Secondly, a full report of the experimental results achieved by AT&T will be made to NASA and thereby the government will be in a position to apply the results obtained for the benefit of any authorized commercial undertaking pursuant to future action by the Federal Communications Commission.

In the third place, we have made very specific arrangements concerning patentable inventions. There may be inventions made as the course of the "work performed under or in anticipation of this agreement." As to these, the government will have a royalty-free license for the practice of such inventions throughout the world or by or on behalf of the United States government in any foreign government pursuant to treaty or agreement.

As to all these inventions, the government will have

the right to grant licenses to others for the practice of such inventions throughout the world for any purpose whatsoever upon such terms and conditions as the administration may prescribe. The government's right to grant licenses is restricted in no both the parties to be licensed and the purposes for which such inventions may be practiced.

So far I have referred to inventions that might be directly determined to be made under or in anticipation of the cooperative agreement. In addition, however, NASA and AT&T have agreed that certain rights are to be acquired by the government with respect to any inventions made as the result of AT&T sponsored research during the period beginning on May 18 of this year and running through to one year after the last launch.

"AT&T sponsored research" includes any project which "has as one of its purposes advancement of the state of the art in communications satellite systems, equipment, components, or ground tracking, transmitting, or receiving facilities therefor." Now, as to any such invention made during the period by AT&T, the government will obtain a royalty-free license to practice the invention throughout the world by or on behalf of the United States government.

In addition, we have specifically agreed that the all invention shall have the right, in connection with the operation of a communications satellite system or the production of components for a system, to "grant licenses to business entities domiciled in the United States, under such terms and conditions as the administration may prescribe for the practice of such inventions throughout the world."

The significance of the patent provisions agreed to by NASA and AT&T is that whatever form of operation this may be determined to be in the public interest and approved by the Federal Communications Commission for providing communications services to the public through satellite radio, that communication will be able to use inventions made by AT&T while in the cooperative relationship with NASA.

As you are aware, the President has stated, and the Federal Communications Commission has emphasized that one of the principles which should govern the operation of a communications satellite system is that there be competition in the production of equipment for the satellite system. One purpose in negotiating the patent arrangements, which I have described, with AT&T is to be able to assure the free availability of any resulting inventions in the public interest.

The AT&T agreement, in my judgment, is a forward step in the development of cooperative relationships between government and industry to obtain in important objective in the practical application of space technology.



BFG FUEL CELLS FIT T-38 LIKE A GLOVE TO INCREASE RANGE

To maximize the capacity of the five internal fuel cells of the No. 38 Talon, every bit of available space has to be utilized. That BFG Goodrich builds the cells in a compact configuration—rather than the usual flat surface—in its ground structural members and other equipment.

These BFG cells are produced in very close tolerances to provide a full-life system with proper fit. Then close quality control has designed No. 38 Talon's assembly operations. And as an added bonus, BFG developed a new fitting which reduces overall fuel cell weight.

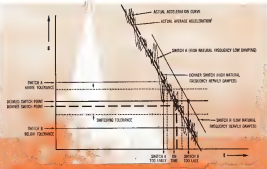
BFG Goodrich maintains complete fuel cell test and development facilities... and has extensive experience in design and production of cells for aircraft, missiles, and ground vehicles. For complete information contact BFG Goodrich Aerospace and Defense Products, a division of The BFG Goodrich Company, Dept. AW 58, Akron, Ohio.



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aerospace and
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There's only one reason to specify Donner acceleration switches



..BECAUSE THEY UNDERSTAND THE MEANING OF ACCURACY

It's dynamic accuracy that counts. In truth, several firms make precision acceleration switches. But accuracy, like reliability, is a term with shades of definition. Some switches are accurate in the lab or on the test bench. That is, they provide static accuracy. But most acceleration switches give you accuracy where it counts, on the operational missile. They are dynamically accurate.

Look at the graph above. Under static conditions, switch "A" with a better overload response, might be desirable. But suppose the missile were experiencing a 10 g vibration of a high frequency nature and proper threshold cutoff demands a 2 g switch point. Switch "B" would eliminate the possibility of early switching, but introduce intolerable phase shift which in turn would make the switch "see" the event when it actually occurred. In other words, under the dynamic conditions of missile and aircraft flight, it is absolutely necessary to know when an event occurred rather than precisely when it occurred. Frequency response becomes a more important consideration than switch accuracy.

Recently dropped, with a high natural frequency, Donner acceleration switches have one phase shift depending the transient response necessary to follow rocket engine

operation and perform their task with maximum full accuracy.

Donner Acceleration Switches are Flexible

Because of the inherent flexibility of Donner's basic acceleration servo system and associated electronics, Donner acceleration switches will satisfy virtually any requirement.

Features include multiple switch points, any speeded damping time, built-in time delays to avoid noise, internal or delayed output, memory damping and total programming capacity.



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WHO'S WHERE

In the Front Office

Thomas V. Jones, a director of Stanford Research Institute, Menlo Park, Calif., has been promoted to chief executive officer of Northrup Corp.

Meredith D. Spreng, president and chief executive officer, AMF, Gersony Corp., Gersony Scientific, subsidiary of Amtek, Inc., has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

John C. Van Allen, special assistant for external affairs of the Scientific Division, will move to Hughes Aircraft Co. as director of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

Stanley M. Smith, a vice president, General Dynamics Corp., San Diego, Calif., has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

General Dynamics/Aerodynamics, San Diego, Calif., has announced the following appointments: **William E. Patterson**, vice president and chief planning officer; **Charles S. Adams**, senior 51 program director; **George W. Robinson**, director of management systems; **William R. Van Horn**, vice president and chief of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

Don W. Jones, vice president in charge of defense systems for the Hughes Aircraft Co., Los Angeles, Calif., has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

Freddie M. Compton, vice president and general manager, Aerojet Engineering, Inc., New York, N.Y., succeeding John F. Ziegler, resigned.

L. A. Gentry, assistant for management operations to the vice president and Special Services Division general manager of Lockheed Aircraft and Space Co., Los Angeles, Calif., has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

Richard A. Fitzgerald, vice president, has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

W. W. Smith, vice president engineering, has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

William F. Gentry, vice president general manager, has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

Richard A. Smith, vice president in charge of defense systems for the Hughes Aircraft Co., Los Angeles, Calif., has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

Robert G. Wolf, director of research, has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

Dr. F. Jackson Wink, director of research and chief executive officer of Northrup Research, Washington, D.C., replacing Dr. Thomas J. Kilian, resigned.

Clayton E. Edmonds, Jr., USN, director of the Naval Surface Electronic Warfare Agency, Fort Monmouth, N.J., has been promoted to chief executive officer of the company's Mobile Research Laboratories (replacing Andrew Hoff who is leaving the company).

INDUSTRY OBSERVER

■ New type of radar for detecting and tracking space vehicles which may provide confusion and prevent existing systems, 100 times better than current radar, is being developed by Rome Air Development Center, Westhampton, N.Y. The radar, called Active Search Frequency Interference Radar (ASFR), WADC, hopes to demonstrate the technique with an experimental system in April 1965 and expects to begin processing hardware in this fiscal year.

■ An Defense Command test, known as modified around had-culture interceptors, have been modified to include the present mode originally designed into the Gears F-106 and the M-106 fire control system. Change in tactics reflects concern over increased performance of Russian interceptors and the need to be able to chase as well as intercept a supersonic target.

■ Six interceptors are in final testing at Holloman AFB, N.M. for the latest radar intercept flight, but there is growing opinion to eliminate the final intercept flight that is now scheduled to provide a second orbital flight. Decision to discontinue the flight could be made as early as late in the month. Atlas-100, which is to place an unmanned Mercury capsule into orbit for a single pass around the earth.

■ Ultra-low pressure radar designs are being studied as possible competitors for electrical propulsion systems in space. Design now being tested at USAF's rocket test facility at Edwards AFB, Calif., use conventional pressure-based propulsion system and radio-frequency waves. Pressure waves across acoustic approaches infinity in duration; pressure approaches the vacuum conditions of space.

■ USAF plans to use a Scout-launched satellite to test the endgame and closing phases for the Scout satellite intercept package, which will be launched by an Atlas-Agena vehicle.

■ Infrared intercept modification program is being carried out on McDonnell F-101 and Convair F-102 and F-106 aircraft to give all these aircraft capability for target acquisition, lock-on and completion of run. Four other modifications are being made to the F-101 and F-106 to improve their fire control performance and other operations in an electronic warfare environment.

■ Air Force has officially dropped the name Bambi for its program to investigate possible techniques for intercepting ballistic missiles during their boost phase. Move is intended to emphasize that the program is a techniques study rather than a weapons research effort.

■ Lockheed QF-104 drones will be phased in to replace the few Vought Republic F-105 drones used in the Defense program. Modified Republic F-105s, one of three drones targets for the program, have been used since the night flight tests before being destroyed.

■ New requirements for instrumentation at the Atlantic Missile Range specified the ability to measure burst radius within 2.5 ft and to determine the circular error probability within 0.1 mrad at a distance of 5,000 mrad.

■ USAF is considering placing permanent deep space observation stations at the neutral point 60 deg. ahead of the moon and 60 deg. behind it in its orbit, because of the combined gravity forces of the earth, moon and sun, only very small amounts of energy would be required to keep the vehicles in orbit.

■ New version of the Beech K20-1 Cardinal target drone, with the 133hp McCulloch piston engine adapted to 150 hp and wing shape clipped, is undergoing flight tests at the McClellan airport, Ft. Ben. Test improvements raise the normal 30,000 ft cruise speed to 25 ft. Earlier version is average six flights per hour against missile production of two flights. Some drones have lasted for 15 flights and one has flown over 28 missions.



RAIN



THUNDER



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HIGH DRIFTING SNOW



EXTREME TEMPERATURES AND ENVIRONMENTS



AIR TRANSPORTABLE

weather bird

Rain (••) had (A) thunder (R) lightning (C) ice pellets, sleet (R) high drifting snow (+) are merely symbols on a weather map—not expected to be problems to the U.S. Army's SERGEANT missile system.

SERGEANT missile system's objectives are to be ready for action in the meanest weather, the most extreme temperatures and environments, at high and low altitudes. It can be checked out by one man with minimum training, emplaced and fired in a very short time by a one-man crew.

The land, sea and air-transportable SERGEANT system, produced for the Army by Sperry Utah—when it becomes operational—will take its place among the tough and dependable sergeants of U.S. Army tradition.

SPERRY



SPERRY UTAH COMPANY, DIVISION OF SPERRY RAND CORPORATION • SALT LAKE CITY, UTAH

Washington Roundup

Research Warning

Defense Department's Office of Research and Engineering, which was worried recently on congressional hearings to give defense research the same kind of flexibility and quick response time that the President is trying to give the military services, has added another member to its list of worries. Arthur W. Robinson, Jr., who has been manager of space business for General Electric Co., will handle international programs.

Sen. Joseph Harris told Dr. Harold Brown, director of the office, that the military research program needs "flexible leadership," and said it must not be the "a priori" mistake that cannot exist moved because it is so big, so complex. "You have got to move fast," Brown, who agrees, said the package program approach to budgeting will help. Sen. Hubert Humphrey, who sees a need for far more government activities on research projects, heads a special subcommittee that is doing considerable staff work to determine ways to improve long-range planning and spending.

Congressional demands for an acceleration of the nuclear rocket program are expected to result from hearings scheduled for Aug. 25 and 26. No legislation is expected to result but Rep. Price will try to push Project Rover and update the record on Stargate, power units and the Pluto nuclear reactor.

Contracting Criticism

Selection of International Telephone & Telegraph Co.'s Federal Division to supply a new \$10-million trans-Mediterranean topographic scatter communication system as part of the Air Force's 483 L. Airframe system has caused suspicion among front companies of the Air Force's 483 L. Airframe system. International Communications Systems Corp., a prime contractor on the 483 L. program, and proposed original specifications for the trans-Mediterranean system procurement.

A similar problem may arise in upcoming contracting for USAF's Headquarters Control System (HQS). International Business Machines, which is testing performance specifications for HQS, is expected to bid for a major portion of subsequent hardware procurement.

Airframe's concern over spending has begun to decline as a result of Cuba's return of an Airframe Electra and a Pan American DC-8. With new legislation expected to strengthen the program and no evidence that the Cuban government is actively behind them, many critics feel that suggested protective measures such as armed guards and helo-drops could pose a far greater threat to passengers and aircraft than the risk is worth. In addition, most critics feel these measures cover such things. This also concludes that passenger safety should be secured at all costs—including that of a state aircraft.

Patent Policing

National Aeronautics and Space Council has told Executive Secretary Edward G. Weisk to police all patent arrangements in space communications. The council already is attempting to develop a government policy for such innovations and it brought justice Department into the National Aeronautics and Space Administration's Aeronautics, Telecommunications and Space Administration. The council was largely responsible for the "no right" patent policy passed established in the AT&T contract.

Vision capacity of Air Force's Aerospace Medical Field Laboratory at Bolling Air Force Base, N. M., will be expanded from 52 to 100 employees under a \$400,000 award from National Aeronautics and Space Administration. NASA originally wanted its own research but congressional objections and the cost of maintaining and outfitting a new facility made duplication of the Bolling facility seem expedient.

Hulaby Speculation

Report that Francis E. Hulaby, director of the aviation department in the city of Los Angeles, will join the Federal Aviation Agency has stirred speculation that NASA's Hulaby may be leaving the administration's post. This is expected to move into NASA as deputy administrator but probably would be the President's choice for the top job of NASA.

British Royal Air Force is not starting a space program as the British press reported recently. RAF Group Capt. A. H. Hewitt, deputy director department of aircraft chief of staff and operations representative, will coordinate and he will deal in all aspects of space technology to United Kingdom defense, and to the RAF in particular.

Capt. Hewitt got this assignment in addition to his other duties because he previously was the unidentified flying objects guru. London's press, intrigued by the testimony between the British Department of Aeronautics Service (DOAS) and the fact name of British statesman Denis Dims, gave the story some ample treatment at this the RAF left a decision.

—Washington Staff

Panel to Probe Bioastronautics Effort

White House group will review civilian, military work to assure broad support for space program.

By George Alexander

Washington—Bioastronautics, a major branch of space technology in which many experts feel the U. S. is moving at half-speed without specific direction, is to be studied by a presidential panel to assure that requirements of future manned space programs will be satisfied by a growing national life sciences capability.

These experts hope the panel, to be headed by Dr. James B. Huntington, technical assistant to Dr. Jerome Wiesner, President Kennedy's special assistant for science and technology, also will put an end to the fighting over bioastronautics between the military services and the National Aeronautics and Space Administration by making recommendations that will clearly define the life sciences roles of each agency.

Earlier this year, Rep. Frank Rosten (D-Calif.), a member of the House Science and Astronautics Committee, issued a 43-page report (AW Mar. 6, p. 27) urging the President to direct the National Aeronautics and Space Council to initiate a coordinated study of all life sciences work in support of space programs. His report also urged that a central bioastronautics authority be created to formulate a comprehensive national plan and that NASA be "convinced from within" to expand its life science research efforts until such a program was established.

Origin of Panel

The Huntington panel resulted from a report from Dr. Edward Webb, an ex-convict scientist, for the space council to Dr. Wiesner for a review of bioastronautics and, one high government official, who is familiar with the panel, said its purpose is to make sure that the bioastronautics capability expands into a truly national program. For these reasons, life sciences personnel—especially among the military—are hopeful that the effect of the recommendations will appear in the panel's final report.

President Kennedy is reported to have received a briefing with the major life sciences concerned with the manned space flight shortly before Col. Alvin B. Shepard's suborbital Mercury-Rocket flight last May 5. At the President's request, Dr. Wiesner quickly formed a panel composed mostly of physicians and to have been familiar with space or aerospace medicine.

When this panel received data on the pulse and respiratory rates of X-15 and Mercury pilots recorded during flights at Military Target Area, they became alarmed at what they viewed could be alarmingly high readings. They suggested that Shepard's flight be postponed until a physiological

study could be built into the pilot's bioastronautics course to measure blood pressure.

Medical program officials, backed by military bioastronautics personnel, overrode the panel that the data was not obtained for well-trained men under the stress of high-performance flights or tests and that the information, though desirable, was not absolutely necessary for the flight.

This experience, undoubtedly, can be related to Dr. Huntington's overall selection of panel members with some background in bioastronautics with

training. As of last week, only two men—both of them physicians—had been chosen. The panel, when fully staffed, is expected to number about 10 or 12 specialists, with both the medical and engineering professions represented. A meeting of the panel is tentatively scheduled for September and the panel is expected to submit its consolidated statement on the Apollo program.

Possible Solutions

Industry and government agencies are several possible solutions to the military-NASA conflict over bioastronautics.

- Two separate bioastronautics capabilities, one civilian and the other military, with coordination at a Defense Department-NASA headquarters level.
- Assignment of some life science activities, facilities and their personnel to NASA on a full-time basis.
- Consolidation of all military bioastronautics personnel, facilities and personnel into one joint military agency.

Agencies would be urged to accept the second proposal to unify the space to operations of the armed forces, but expanded to handle all civilian space needs.

A high-ranking military official would be assigned to NASA in a liaison capacity to integrate the requirements of the military program.

The first proposal, these observers say, would be prohibitively expensive

First C-141 Subcontract

Part of 2025 new subcontracts for the Lockheed C-141 transport awarded by USAF in a program being closely monitored by Congress and the White House was awarded last week to Rohr Aircraft Corp. for plans and technical support work. Rohr was the holder in the competition.

Initial contract orders also stipulated that follow-on work be awarded. Rohr will manufacture plans and components at its Clark Vets. Calif. plant and assemble them at its Walnut, Calif. plant, where Rohr has been making C-130 aircraft. Under a about 15 to 20 million Lockheed's Martin, Calif. plant where the C-141 is the Lockheed 500 commercial version will be assembled.

Handling of subcontract contracts is expected to be a slow process as they were up to Air Force officials, including components and Executive, some of the, although pressure to cut defense costs has increased with the onset of the fiscal crisis.

and would probably lead to areas of duplication and controversy. The second, if it could be accomplished over the inevitable pattern of the military would virtually eliminate the third source from the bioastronautics field—a result which would mean that certain congressional quarters would be likely to accept.

Military personnel feel the deal against the most appealing, but NASA feeling that the service has too much or hardware investment in the case in a cockpit—despite if this arrangement would satisfy, as required, as for research on other bioastronautics research such as extraterrestrial life, space, health and other particular needs, but remained to be seen.

Attention, therefore, focuses on the Huntington panel and the report it will forward to the President. Most observers believe it will take a considerable duration, the struggle over the present compromise in bioastronautics.

The Air Force, which has been the most complacent of the three services, has begun considering the idea of an autonomous space medicine and bioastronautics unit under a new directorate to be formed in the Air Force Systems Command.

A memorandum is now being circulated among all existing USAF units, suggesting that, under the conditions of the proposed consolidation, the Aerospace Work has learned that the basic decision has already been made with considerable consideration. The House Aerospace Medical Committee, headed by Sen. Anthony, will be transferred from Air Training Command to Systems Command in the near future.

USAF and Navy Unable to Agree On Joint Tactical Fighter Project

By Larry Zoods

Washington—Possibility that Air Force and Navy could agree on a single configuration for an as yet unspecified tactical fighter (TFX) dropped last week.

A proposed memorandum for the signature of the two service secretaries, according to Secretary of Defense Robert S. McNamara, that they could not reach a compromise, was circulated through Air Force and Navy staff offices. That what was first proposed as a single to serve as tactical fighter in President Kennedy's budget message last May 18 now is a specific idea to be made accurate instead (AW Apr. 17, p. 38).

As earlier divisions had already split off the low altitude, close support, stand-off and short-landing mode aircraft (VAX).

As force wants to meet that one by high-bay or important mission at the end of the service program, the proposed document in McNamara's. This was done when the VAX project was split off to build the ground support mission, leaving reconnaissance, reconnaissance and reconnaissance in the TFX.

Agreement on the VAX between the Army and the Navy is now. Requests for proposals will be sent to industry about three weeks after agreement is reached. The VAX project has been in the air since the proposal has been in the air since the configuration has not been chosen (AW Feb. 27, p. 35).

50,000 lb. Air Force, minimum of 65,000 lb. In length, Navy wants 56 ft. to allow the folding feature but is willing to accept more length and incorporate the folding.

TFX is Air Force subcontract for the Tactical Fighter, Experimental VAX is Navy technology for Hercules that is Air Force, Experimental VAX has experience of the VAX program.

Although there is no indication that the current Secretary McNamara will make any decision on the matter, enough has been said by President Kennedy and McNamara on the subject of the type of conventional weapons rather than nuclear weapons that another aircraft designed to deliver nuclear weapons may not be well received.

It is possible that the office of Defense Research and Engineering will agree to pay the cost of continuing the development of the service program, the proposed document in McNamara's. This was done when the VAX project was split off to build the ground support mission, leaving reconnaissance, reconnaissance and reconnaissance in the TFX.

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LTV Anti-Trust Suit

Anti-trust suit was filed by U. S. government against LTV Space Electronics Inc. and Chase Vought Corp., Dallas, Tex. Jan. 14, along with division of the merger of the two firms and asking for a temporary restraining order in Dallas District Court to hold up the merger. Less than four hours prior to the filing, the board of both companies had voted to approve the merger and the board of the newly merged company then held a meeting some three hours prior to the Department of Justice action. Government claims that the merger violates an order of the Clayton Anti-Trust Act—usually blocking competition between the two major producers of communications and leading to a monopoly in the industry which operates satellites on the ground. Dallas District Court judge denied the federal motion for a temporary restraining order and ordered a hearing on a preliminary injunction for Sept. 11.

Grand Jury Checks Semiconductor Pricing

Los Angeles—Pricing practices of semiconductor companies will soon enter the scrutiny of a federal grand jury convened in Dayton, Ohio, last month. Indications are that other companies will be required to produce similar information.

The seven firms have been used to produce pricing trends going back to 1967. Names of all companies in which data had nothing to do with pricing of semiconductor components will be in all companies relating to pricing during the indicated period are among the subpoenaed information. Each company will also be required to supply data of manufacturing, names of corporate officers, etc.

Companies listed in the inquiry include Motorola, Fairchild, Inc., Williams, Mass.; Texas Instruments Corp., Milledale, Md.; the Semiconductor Division of Hughes Aircraft Co.; Newport Beach, Calif.; Rymco Corp., Waltham, Mass. and Pacific Semiconductor, Inc., Cedar Falls, Calif. Grand jury reportedly seeks a comparison to the metropolitan New York area and another in the Midwest.

The grand jury action comes as a surprise to industry sources despite earlier Department inquiries among component firms. Federal had requested data about pricing of sales to the military, provisions of sales to general semiconductor device categories, etc. Information of a similar nature to that supplied on a quarterly basis by the industry to the Department of Commerce's Electronic Products Research Agency.

These points point out that prices of semiconductor devices are continuing to drop sharply and therefore do not suggest any possible conspiracy to fix prices. It has been an average company finding in the industry is that some device lines are in demand or not, being sold below cost (AW June 18, p. 75).

French Pressing IRBM Pace Despite U.S.

Paris-French government is pushing ahead with development of its nuclear armament despite the Kennedy Administration's reluctance to lift a 1959 law which prohibits U.S. companies from cooperating with the French on such projects.

French had hoped President Kennedy's visit to Paris last April would bring about a change in U.S. attitude. U.S. companies, led by Westinghouse in 1959 to cease working with the French on nuclear reactor projects, also had hoped they might be permitted to resume such activities.

So far, however, no change since U.S. sources who repeat claim something has to be done, the Kennedy Administration has reiterated the no-exception principle laid down by former President Eisenhower.

In particular, France could use U.S. technical aid in its intermediate range ballistic missile development as well as crucial nuclear fuel, but the French nuclear energy plan, which U.S. scholars say is the model vehicle could be given by executive decision. Nuclear fuel elements for French reactors would require congressional approval. "It is almost done in those projects which the French, even without U.S. aid, will complete there. But to do so will take considerable, longer—and nuclear more expensive—than of U.S. help can give."

The U.S. has one American company working with the French on missile vehicle projects now quickly laid down in September 1959 (AW Dec 7, 1959, p. 26). At that time several U.S. missile companies already were deeply involved in the work, and the Soviet joint think tank in Washington (L'Esprit Militaire) (SEREB) a number of French companies set up earlier in 1959. SEREB's main mission is to coordinate efforts of French companies taking part in the IRBM project, as well as to deal with U.S. or other foreign companies which could do the project. The 1959 law apparently agreed to in both Pentagon and State Department officials, specified of working arrangements between U.S. companies and SEREB.

Reportedly, motivation behind the present Administration's reluctance to cooperate with the French on nuclear armament is different from that of former President Eisenhower's.

The latter, in an important NATO summit meeting in December, 1955, agreed to help NATO develop an intermediate range missile as an IRBM. It was thought that was the best way to meet NATO member states about having to rely solely on U.S. nuclear armament. His day then decided, even though the Eisenhower Administration would refuse to do it, to help as single NATO member, such as France, develop its own nuclear weapons.

With the Kennedy Administration, however, French had that same motivation in Washington's desire to prevent proliferation of nuclear armament, rather than a NATO-wide group as in helping a single nation such as France. However the reason, French officials are no longer covering up U.S. aid. Many of them, in fact, take a special pride in France achieving its nuclear position on its own. In any case, here is how French independent nuclear armament plan are changing.

•**IRBM.** SEREB's work in this field is, of course, delayed. French, however, still are planning to have an IRBM weapon ready sometime between

1965-70. Present planning calls for a solid-fueled missile with a range of 1,400-2,500 mi. Missile would be equipped with nuclear warhead using nuclear enriched uranium, produced by a 300-million-watt uranium plant being built at Pierrelatte, in southwestern France. Completion date for this plant is uncertain in 1966.

•**Guid.** SEREB develops its IRBM. France's nuclear strike force will be built around Mirage IV two jet bombers carrying plutonium by the ton. Mirage IV bombers, of which 50 are being built at a cost of \$280 million, are scheduled to be completed by 1964. Project already has limited supplies of plutonium produced at its atomic center at Marcoule.

While SEREB officials would admit their task would be lot easier if the Soviet aid were forthcoming, there is a guard against such with missile development by date. First SEREB must make sure it is not launched in the Soviet by the Soviet. Chiefly because of the Soviet, the project was possible by a solid fuel element carrying two nuclear tons, the heaviest solid fuel charge yet to be fired by France. Two kinds of the non-fueled Agate were used. In intermediate project, a solid fuel element carrying 1,000 lb. the largest French missile to be fired by solid-fuel element to an altitude of 40 mi.

SEREB officials did not repeat whether Agate is a derivative of IRBM concepts, at which it is clearly a solid missile test vehicle. In addition to military market, SEREB also can get involved in purely scientific rocket work—although building France's IRBM concept is involved in it.

•**Nuclear submarine.** In the field of nuclear propulsion, U.S. and is attracted to limited supplies of U-235 for land-based prototype reactors. No technical relationship, however, the French nor can the French get enriched uranium fuel elements for ongoing submarine reactor.

Thus the French Navy, working with the French Atomic Energy Commission, is developing a half scale land-based prototype of a submarine nuclear powerplant at Cadarache. The reactor will be a pressurized water type with power output comparable to the American Skunkjet class. Fuel will come from the U.S. but the nuclear design will be French. Prototype is expected to be completed by the end of 1963.

Plans for France's first nuclear powered ship are included in the 1963 French nuclear development program. Just how much nuclear aid the French can build depends on their capacity to produce enriched uranium at the Pierrelatte plant.

NASA Launches Explorer XII To Measure Energetic Particles

Washington—Explorer XII, an cosmic satellite, for a variety of radiation experiments, was launched into a highly eccentric orbit last week from Cape Canaveral by the National Aeronautics and Space Administration.

Placed in an orbit of 170 mi. perigee and a 40,000 mi. apogee by a three-stage Thor Delta launch vehicle, Explorer XII was the first of a semi-disseminated 5-1/2-day series of satellites which will investigate solar plasma, cosmic radiation, interplanetary magnetic fields, the extent of the earth's magnetic field and the charged particle population both in space and in the Van Allen radiation belts.

In the course of its 31-day orbit, the satellite is expected to pass twice through these radiation belts. The Explorer is equipped with four solar paddles containing 5,600 solar cells, and a water, 136 mi. per second, and 100-100 mi. per second.

The octagonal-shaped 61½" satellite carried the following experiments:

•**Proton analyzer.** built by NASA's Ames Research Center. This 1.5-lb device will measure the low-energy proton flux and spectrum from 1,000 to 40,000 ev. Data on these particles believed to constitute 55% of the ionized matter in space, will provide knowledge of proton concentrations in solar wind and will be indicative of particle activity in the Van Allen radiation belts during solar disturbances.

•**Magnetometer,** developed by the University of New Hampshire. This magnetometer will be contained in a 600-gm sensor unit and a 700-gm electronics package, will measure the magnitude and direction of the earth's magnetic field between 12,000 and 40,000 oersted. The data will investigate the possibility of the earth's magnetic field increasing at 40,000 mi. and off the data will be used to calculate theories of extra-terrestrial cosmic ray sources and magnetic disturbances, especially in this context, with solar storms.

•**Trapped particle radiation device** built by the State University of Iowa. The four Geiger counters in this instrument will measure proton dose 18 mi. and 50 mi. and the electron between the bands 40-55 mi. 40-100 mi. and above 2 mi. and 10 mi. The three radon-alpha detectors will measure the total energy flux of protons and electrons and low-energy gamma detectors. Total weight of this instrument is 3,000 gms.

•**Cosmic ray instrument,** built by NASA's Goddard Space Flight Center. This

instrument, comprising a 28-in-long, 2.5-in-dia. double telescope, a single cosmic alpha crystal detector and a second 5.2-in-long, 2.5-in-dia. tube stage, will measure the charge and energy spectra of cosmic radiation at a function of time, direction and distance from earth. Since many interplanetary phenomena are manifested by solar plasma, NASA feels that this device also should give accurate field and plasma data.

•**Ion detector detectors,** prepared by Goddard. This unit, weighing 1,360 gms., will measure the flux, type and energies of particles in space and below the Van Allen radiation belts in a function of direction, time and position.

•**Solar cell instrument,** developed by Goddard. Consisting of four strips of 10 silicon solar cells, this device will measure direction and energy of solar cells exposed to the Van Allen radiation belts. One strip is unprotected the other three are covered by 1, 10 and 60-mil-thick glass plates to determine the effectiveness of glass filters.

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Russia Considering Opening Space Steps

Washington—Soviet Russia has begun making plans to allow foreign correspondents to witness landings of its space rockets—but this may not be done until, and unless, agreement is reached on total disarmament.

Leonid I. Selov, head of the USSR Academy of Sciences' cosmophysical travel committee, told 1,500 newsmen and scientists who attended a press conference in Moscow, Aug. 31, he has details of Max Gherman Tim's speech.

Right at the start that their plan is under way. "You must understand, a corner rocket does not have only practical purposes (if the Americans had such perfect corner rockets, they too would not have revealed their secret as they have now, revealing their hand, and would)." Selov did not specifically refer to whether of Soviet space steps to disarmament, but he said only after disarmament will they be "no longer for science."

Mr. Timov, in answer to a question that Soviet space exploration was solely peaceful purposes, and "the ship Vostok II has not been developed, has not been adopted for the purpose of carrying loads."

Timov was the last appearance of weightlessness was that he was flying with his last report, that the astronaut did not last long. Prof. Vladimir I. Yakovlev, told the conference that Timov's "unusual" weightless state caused certain changes in his vestibular system which at times give rise to unpleasant sensations. "The organ of the ear helps to control the sense of balance. After Timov's unusual position of the body and made no further sharp movements the organism almost disappeared, Prof. Yakovlev said. "After sleep, these changes disappeared completely and the feeling of motion was switched on," the professor said.

Timov said he had no particular apprehensions, but that this may have been due to confidence. He never cited the heaviest of his experience, but in sleeping pills, signed a five-page autograph which he signed the first leg and took pictures with an ordinary press camera, he said.

When a reporter asked if Timov intended the situation of weightlessness in space would be produced "the same effect on earth," Timov replied "To tell you frankly, I did not see. I have the opportunity to see Timov and had not."



SOVIET Cosmonaut Gherman Timov told newsmen in Moscow that he carried his last from the Vostok II spacecraft into his descent and landed by parachute. He did not make a view whether the chute is attached to the suit is a personal choice. However, he said at least one orbital aerial flight symbol is through hole seen here in the chute deployed at the recent Vostok mission, which Serebren and was Vostok II.

AGATE MISSILE, one of two first missiles by French in the future, seen in a flight which lasted 10 to 40 mi. altitude.



Lockheed F-104Js Prepared for Delivery to Japan

Lockheed F-104J Super Shuttlefighters bearing insignia of Japanese Self Defense Force take off from Lockheed test station at Palmdale, Calif. Lockheed will build 15 of the fighters and Mitsubishi Heavy Industries/Kanagawa will build an additional 127 aircraft under license. Plans are flown by Lockheed test pilot Charles A. Kitchens. Many differences between earlier versions of the F-104 and the F-104J is noticeable: a different fuel control system, painted, bomb receptacle and the North American control system and wing rider. The F-104J is somewhat heavier than the U.S. version but will perform at about the same speed.

Teamsters Open Bid to Organize Lockheed-Georgia Defense Plant

By Arnold Sherman

International Brotherhood of Teamsters' effort at organizing the Lockheed-Georgia Division follows an announcement by James Hoffa as Union last month that his union will accept into defense industry. Lockheed-Georgia is the first aircraft plant targeted by the Teamsters.

The Teamsters named Lockheed's International Union of Manufacturers' Local 15 as their immediate objective recently after a meeting of the union's Atlanta, Ga., headquarters. According to Robert Cook, president of the Teamsters' Atlanta operation, 115 leaders from various Lockheed production departments attended the Sunday meeting. Although there is some dispute as to what the union meant by "leaders," and various newspaper sources have judged the figure at 75-100 rather than 115, it is agreed that the workers represented voted overwhelmingly to ask the Teamsters to intervene. Also it has become apparent that the Teamsters now are committed to a strenuous program to organize the Lockheed-Georgia plant unit.

Lockheed-Georgia, which has suffered an appreciable amount of lay-offs, is regarded as vulnerable to Teamsters' intervention. Over the three preceding years, according to Lockheed sources, the labor force dwindled from 20,000 employees to 10,000. The situation has improved, however, to the extent that

11,000 workers are now employed in the Georgia facility. With accelerated C-119 production approved by Congress, Lockheed sources are reasonably confident that the labor situation will take an added upswing although it is doubtful that the labor force will exceed a peak beyond the 12,000 mark in the next future.

Since workers had to normally give their right to organize a vote in selecting a union, the unorganized workers, and particularly in the case that proportion of those workers who are members of the IAM, could play a key role in union organizing. There were 3,000 disorganized members of the IAM working at the Georgia plant. Of these an estimated 1,800 have been laid-off. It could take approximately 1,000 votes for the Teamsters to successfully petition the National Labor Relations Board for a union election.

An added factor in the Teamsters' IAM controversy was a District 11 hold order management. The parent IAM body, however, did send its own representative to Lockheed-Georgia "to straighten matters out." Another factor cited was Lockheed's development of a number of positions during the period of layoffs. Although the firm claims that without the downgrading action, more workers would have been retained, more workers have objected to the action.

Local IAM leaders are calling on the AFL-CIO to organize in the Teamsters' behalf as a method of getting the Teamsters on the defensive—thus reducing the maximum level of union pressure.

The machinists' union has a contract with Lockheed effective until July, 1962. This, however, does not preclude the fact that machinists in the NLRB rely for union elections between 60-120 days prior to the signing of a new contract, the next contract will see no increasing effect on the part of the two unions involved to limit up to twenty votes is possible.

On the 180,000 employees who form the nucleus of the Teamsters' effort to organize Lockheed-Georgia and contact the IAM, many are disorganized as IAM officials in the last union election for officers. The disorganized Lockheed workers are led by R. Sellers who was defeated by IAM district president E. A. Davidson, in the last election. Last year local IAM members announced that if dual contracts in reference was shown that he would lead the union and the Teamsters' camp if he was elected, and the national IAM headquarters declared Sellers eligible to hold any union office for a period of five years.

The Teamsters, who deny that they are making and insist that they have been asked to intervene in disorganized IAM members, scheduled another meeting late last week. Local IAM officials are claiming, however, that workers are being paid to pick new members they enroll in the Teamsters' corner and that, in fact, a \$1 million war chest has been set aside by the Teamsters for the "Lockheed-Georgia takeover."

NATO Invitations Out For V/STOL Fighter

North Atlantic Treaty Organization has sent out invitations to selected nations asking for forward bids on both the long-awaited NATO V/STOL (vertical/short takeoff) fighter competition and for a V/STOL transport aircraft. Dead line for the transport bids is mid-November for the close-support fighter, Dec. 31.

A number of U.S. as well as European firms have been invited to submit proposals, although the NATO specifications for the two aircraft require that a consortium bid in several instances as various countries will be present. A Pentagon briefing of interested U.S. industry representatives is scheduled to be held on Aug. 24.

News Digest

First Saturn 54 booster arrived at Cape Canaveral Aug. 15 aboard the Navy cargo ship *Albatross* after a 10-day, 2,300 mi. trip from the Marshall Space Flight Center. Launch of the 54 with steel upper stages and payload is scheduled for later this year.

Adm. James S. Russell, former vice chief of naval operations, has been named commander of all North Atlantic Treaty Organization forces in southern Europe, replacing Adm. Charles R. Brown who retired Jan. 1.

New world's speed record of 10.1 mph over a 9 to 12 mi. course for a sailing ship has been claimed by the Soviet Union. The plane, identified by Niles, can ride out at Juvang Bay in the Yukon as show last month in support of the B-5 (AW) job 24, p. 30.

Second attempt to orbit an S-45 experimental satellite is scheduled for this week at National Aeronautics and Space Administration's Wallops Island, Va., station. First attempt, last June 30, failed about the third stage of the last stage Scout vehicle did not ignite. Present payload has been used to ground on successful tests. Orbit is expected to be 280 mi. alt. at perigee and 810 mi. alt. at apogee.

Boeing Co. will receive major orders within five to eight months for 853H aircraft and six for the new model to replace some older models under a \$11.3 million USAF contract. Work will be done at Boeing's Wichita, Kan., plant.

Prototype Rock 396 two-engine composite plane (AM Aug. 7 p. 29) made its first flight Aug. 15, but will not be shown publicly until Sept. 4, at the Palm Beach air show.



Ranger to Be Launched by Atlas-Agena

Ranger deep space probe, tomorrow at latest report arrives, is now scheduled for launch this week aboard an Atlas-Agena vehicle from Cape Canaveral, Fla. Probe aimed upward end of payload section is a photometer blinder through which cooled telescope is mounted to maintain temperature for astronomical loads. Blinder is disconnected just prior to launch.

Army's Learning Division and FMG Corp. have been awarded by Navy from among 11 bidders to build one prototype each of a Landing Force Amphibious Support Vehicle, Hybridized (LVTH) Army's \$1,350,000 contract calls for a vehicle which can transport heavy loads on a road, over rough terrain, and over water. The contract calls for a vehicle with one surface propeller for forward and a retractable hull aft. Speed is to be 15 kt. and also on water and more than 25 kt. on land.

McDonnell Aircraft reported final contracts after time for the final year ended June 30, 1961 were at a new high of \$11,179,517 as compared with \$12,082,074 for the previous year. The average per share for fiscal 1961 was \$7.54 compared with \$5.93 for the previous year, based on 3,425,445 shares outstanding on June 30, 1961, and 3,461,495 on June 30, 1960.

Naval-Dough AD-3A, a long-range, high-speed reconnaissance aircraft of the A-40 series powered by the Pratt & Whitney

no. F17-P6 engine, has made its first flight at Edwards AFB, Calif.

Lt. Gen. Joseph F. Canale, inspector general of the Air Force and commander of the World War II of the Office of Special Investigations, has been named director of the new Joint Defense Intelligence Agency.

Bell TRC-104 made its first flight at the company's Plant, Tex., plant Aug. 16, opening Phase I of its test program. Powered by an 1,100 hp, Learning TRS-19 turbojet engine, the latest version of the Army's Acoustical Reconnaissance is designed to carry a payload of 12 fully armed troops. Cabin area of 220 cu ft is available, compared with 140 cu ft, is further modified, through trisection of fuel tanks.

General Electric Co., Mobile and Space Vehicle Dept. has secured a \$1,153,000 Air Force contract for research and development on the Sinter II program.



QUICK TURNAROUND of Continental 7B at Denver begins with material ramp moving to front hatch, followed by crew with golden



AS FUEL TRUCK STOPS (above) power unit connection is completed, and ramp operator descends. Before left, baggage cart approaches. Two



Jet Utilization,

By Robert H. Cook

Denver-Continental Airlines' intricate efforts to maintain a steady profit level during the jet transition has made it a focal point of competitive concern and currently, because of its ability to achieve virtually low break-even load factors while enjoying the quality of its scheduled service.

The Continental formula, which concentrates on holding all costs to a predetermined minimum while speeding the maximum service production from the fleet of five Boeing 707-120s and 11 800 series Viscountes that provide



aspect. Power unit approaches from left and fuel truck comes outboard of No. 4 engine pylon. Second ramp approaches rear hatch.

Cost Control Increase Continental's Profits

90% of the daily cost index has cuts pulled the airline from a net loss position of \$112,000 in 1958 to a healthy \$1,795,280 net profit in 1960.

The success of Continental's service is provided by the Douglas DC-7B, a DC-6B and five leased DC-4s. Future plans call for a quick phaseout of most of the piston equipment, which the airline feels is too costly to operate.

Paired with heavy competition from American Airlines, United Air Lines and Trans World Airlines over its most profitable routes—predominantly from Chicago to California—Continental has carefully tailored its entire operation

toward proving that the high revenue potential for turboprop aircraft must not be paid for all other operations.

Following this logic premise, Continental has consistently increased its average daily aircraft utilization and lowered the break-even load factor to a point where its Boeing 707 turboprops last year turned in an actual utilization rate of 18 hr. 15 min., the highest in the industry. This figure now stands at 14 hr and 40 min with new service between California and Texas and was scheduled to reach 15 hr with the inauguration of new service between Kansas City, Denver and El Paso.

High utilization implies low load factors. Thus Continental's drive toward high utilization carries the essential corollary of strict cost control to provide correspondingly low break-even load factors.

As an example of the rewards possible with this philosophy, Continental points to 1960 year-end figures. These show that while its actual 30.5% system load factor was the lowest among 12 domestic trunk companies, its break-even load factor of 44.6% produced an operating profit equal to 10% of the airline's gross sales of \$61 million. Compared from Civil Aeronautics Board fig-

between trucks are in position on aircraft's right. Front view shows two dual trucks in position, baggage truck elevated.





How to fly 625 miles an hour at 30,000 feet... (without leaving the ground!)

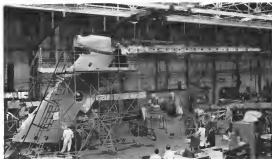
You're looking at an Air France Boeing 707 flight simulator—an electronic "plane" which never leaves the ground. This amazing device is available in training Air France jet crews to meet the precise, exacting demands of actual flights, and it's also a required test in the refresher courses taken every 6 months by every one of our 6,000,000-mile jet pilots!

During a simulator "flight," every imaginable flying condition can be reproduced—and the entire operation, including crew reactions, registered on

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First Vickers VC.10 Tailplane Gets Functional Tests

Tailplane of the first Vickers VC.10 tailjet transport is lifted into position for functional tests at the Burs, England plant of Vickers-Armstrong (Harlow). Tailplane, which has a 46-ft span, will move later to the main assembly line at Weybridge for mating with the first fuselage. Elevator and a split air flow independent aileron activated by an electric-hydraulic unit, Vickers say, if not tested and proved satisfactory in full deflection, the three remaining tailplane cow panels the airplane said the tests will be carried out. The first tailjet transport can be controlled with a single test rack, according to company sources.

the engine has also been changed on all but one engine on the Boeing.

Contracted vacuum is the testing, the fuel and air intake bearings on the engine and expects to complete the work before the 1,600-hr work is reached on the powerplant.

Maintenance on the Boeing fleet has been reduced and speed of the aircraft increased on extended night tests in replacing the old 72-tube nose up-passages with a new compressed air tube design. Cullen said. Plans are still in progress to lengthen the Boeing vertical stabilizers to 16 ft.

No major changes are planned to integrate the Boeing 720B into the maintenance program, says Cullen, except to set up a conventional engine engine and accessory section system for both the JT1 engines and the JT1D-1 turbo fan engines.

Airframe Overhaul

Airframe overhaul on all aircraft is completed at Los Angeles. Engine overhaul on the Vickers test and for Rolls-Royce Dart powered aircraft of several model series, is conducted at the Burs, Eng. Overhaul of the Boeing engine has been completed for the past several months in the Pacific Aerospace Corp. at Burbank, Calif. Jones, Grand Central Airport of Glendale, Calif., has been handling the

DC-7 powerplant overhaul work.

A structural expansion of the Los Angeles test maintenance base is planned for completion by next March and will permit maintenance crews to work on three Boeing aircraft simultaneously. Present maintenance at the Los Angeles base is two aircraft.

First transition to the new tailjets was accomplished on June 16 to 35 hr running and run-in tests by the crew past a experience with Vickers aircraft according to Don Wilson, vice president. The hour of run-in experience with tailjets and Boeing test flights, Wilson said, and the entire test program that flight crews would have to adhere to that "cockpit discipline" in both a safety and an economy context, are dictated by the tailjet's different and "unfamiliar" flight characteristics.

Superior pilots took the first test run, testing, perfecting flight procedures which they later taught to regular line pilots.

Correcting the flight habits which pilots had developed in piston equipment was the main problem, requiring increasing maneuvers on one high take-off and landing, with a touchdown at least 1,000 ft down the runway, Wilson said.

Crews are continually observed to assure that they follow these standard procedures and habits to do so in an

efficient sufficient grounds for a check ride, he said.

Overhaul centers, is further assisted by other "cockpit discipline" procedures calling for the early use of reverse thrust on touchdowns, selection of the shallowest possible air masses and the use of the first high-speed turnoff to reverse. The latter practice alone, Wilson says, has reduced fuel use on all aircraft scheduled arrival time, Wilson added.

Cargo Revenues

Continental's cargo revenues, as 70% during the first six months of this year over the same period last year, are playing a more significant role in the company's profit picture. Cargo revenues last year, in fact, were 35% above those of 1959.

New profits for each special commodity, such as Boeing, past bills of lading for off-peak periods and different rates designed to provide "top-off" loading have contributed to this rise. Probably the largest increase has resulted from a change in freight rates, says Wayne, the largest increase has resulted from a change in freight rates, says Wayne, the largest increase has resulted from a change in freight rates, says Wayne.

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Division of UNITED AIRCRAFT CORPORATION, Stratford, Connecticut

Newark Airport Noise Report

These comparisons were made from data gathered by Howard C. Hardy & Associates and presented in reports to New Jersey Gov. Robert B. Meyers concerning relative noise levels of various types of aircraft arriving and departing Newark Airport.

Aircraft type	Distance from Existing Inletment (in feet)	Minimum FPNdB [*] Recorded
	Landing at Newark (Runway 22)	
Electra	700	95
DC-7	870	99
Caravelle	1,000	104
Caravelle	780	108
Vickers	980	105
Takeoff from Newark (Runway 22)		
Comet 440	2,100	91
DC-6	1,000	104
Caravelle	1,700	97
Caravelle	4,800	94
Comet 440	6,300	100
Takeoff from 10th-10th		
DC-7	2,500	104
707-120	600	115
720B	1,100	104

^{*} Perceived noise decibels

Jet, Piston Noise Reported Equal

Short- and medium-range, turbojet aircraft operating in and out of Newark Airport should create little or no noise above levels presently generated by piston-engine aircraft, independent reports released last week by New Jersey Gov. Robert B. Meyers indicated.

The previous report was made by Cornell Aeronautical Laboratory, Buffalo, N. Y., at the request of Gov. Meyers and at no charge. A supplemental report on aircraft noise was made by Howard C. Hardy & Associates of Chicago. Data obtained by the firm also was incorporated into the Cornell report.

While admitting there is no significant or a decided reduction of noise on the boundaries between tolerable and intolerable noise levels, Cornell noted as a finding (just the 111 perceived noise level (PNdB) level established by the Port of New York Authority as its maximum allowable jet noise level. This noise level is approximately equal to a transport take-off, on subjective grade peris in operation or the noise level in a jet engine test cell noise. It is slightly below the noise level generated by a multiple subsonic unit in operation.

The PNTA says that approximately 60% of all jet takeoffs at Newark Airport exceed this level. The PNTA does not consider landing noise.

Tests indicated, the Cornell report said, that takeoff of short- and medium-range aircraft from Newark Airport would produce noise levels of maximum

ing construction similar to or perhaps somewhat less than the noise level generated by a DC-7 taking off, provided that the jets made appropriate power reduction and steep gradient descents. On the other hand, the report continued, jet noise moving the ground during landing will exceed the noise now generated by landing DC-7s.

Night Ban Proposed

Based on which has adopted the youth law as a decisive measure, contends that there is little prospect of translating "the more than 100% traffic increase required to offset the normal loss and additional cost of passenger handlers."

Michael complained that "inadvertent" college youths and unknown would be able to detect the "subtle" changes in air traffic capacity by making light air reservations under fictitious names hours or days in advance. Thus, as departure time nears, a youth could board as a student.

When the fictitious passenger failed to appear, securing a "no show," the youth could get his seat.

The "no show" problem could be solved in other ways by two or more airlines offering youth fares. In this case, a youth could make American reservations on several airlines days before departure. Just before flight time, he could get on the standby list. Then, when the standby reservation became "no shows," he would be seated at least on at least one of the airlines.

For the second quarter, net income was \$57 million after taxes, compared with a net profit of \$44 million in the same period last year.

Three Carriers Ask Youth Fares Probe

Washington—Opponents to youth fares proposed earlier this month by American Airlines and adopted by two other airlines have prompted three U. S. senators to ask Civil Aeronautics Board to suspend and investigate the promotional tariff.

Senators Sen. James, Michael, Andrews and Russell A. Brown have objected to the youth fare plan which would allow passengers between the ages of 12 and 27 to travel at half the first-class fare (AWA Reg. 7, § 17). To be eligible for the youth discount, a young passenger could not make reservations for space prior to 14 days before flight time, but he could board aircraft on a standby basis.

Senators—check out of late last week was the only airline that had not filed for the youth fare—contends the tariff is proposed by American is based on faulty information concerning the number of passengers between the ages of 12 and 27 among American airlines. American estimates that 15% of its present passengers are in this age group. Eastern cites a survey of its "airber" and "air shuttle" services—showing far less discounts of up to 50.1% and 25.1%, respectively, to all passengers—showed that 9.1% of urban and 15.7% of its shuttle passengers ranged between 12 and 24. Eastern said that in spite of the greater discount, its fares for youth, a higher percentage of young passengers and the more expensive no-shuttle—indicating a lack of correlation between low fares and the stimulation of youth travel.

Eastern, which has adopted the youth fare as a decisive measure, contends that there is little prospect of translating "the more than 100% traffic increase required to offset the normal loss and additional cost of passenger handlers."

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Eastern Evaluating Shuttle's Economics

By Glenn Garzka

New York-Eastern Air Lines' "jet shuttle" is tapping a new market among business, who formerly used ground transportation, and also is drawing a portion of the business commuter type found in the high density market. Income industry interest has been aroused by the New York-Boston, New York-Washington, no-connection reduced fare service (AW May 1, p. 46).

However, a big question is whether the shuttle can justify itself economically. The Lockheed Super Constellation equipment used as is the service is depreciated and would otherwise be surplus, but there are other costs of operation out the front of such a new operation. The service involves a scheduled airplane and crew plus a backup airplane and crew for every departure. On Aug. 1, the frequency between New York and Boston was increased to six hourly flights, between New York and Washington, schedules increase at even other than hourly intervals.

Eastern is not gambling its shuttle operation strategies, but President Malcolm MacLachlan told Aviation Week & Space that a new, approximately bankruptcy even. Load factor must be 50% or better, he said, and no better than 50% because load factor is said to be about 50%.

The airline definitely plans to screen the experiment over October when the initial period would end, MacLachlan said. The only question in response was to whether or as least basis as set back to even two hours between New York and Boston. Experience with the New York service will decide that question.

Heavy Competition

Eastern's shuttle service is operating against heavy competition in the big New York-Boston and New York-Washington commuter market. North east Airlines offers hourly service, flying north, Veolia-Vermont helicopters, with some DC-10 and some Garuda 350 jet shuttles scheduled in August, says Airlines also flies hourly schedules and jet week, adding schedules between 1 p.m. and 6 p.m. to provide service even half hour during three peak periods. American's equipment in the market now is almost entirely Lockheed Electra, which are dual configuration aircraft.

American took as opposite view from Eastern in the market by putting in "passenger" Captains. The term, flight kitchen is a check and other services at an extra charge of two dollars. These flights first operated about noon

and in the late afternoon, the noon flights have been discontinued—they stood up only at that time of day—but the afternoon de-lux flights, American says, are doing very well.

North east says its business in the market has not suffered since Eastern began its shuttle. North east's traffic in the commuter market is up 10% over last year, the airline said, and last but not least was too. North east's view is that the Eastern service is appealing primarily to the non-business type of traveler.

American, however, believes the shuttle is sharing the existing market rather than opening up a significant new market. American questions the value of the service from an industry standpoint. If it is financially unwise, the cost of the good, any and all covered by the revenue it brings in and it only hurts all the airlines.

Eastern has two services, each a week's duration, of its shuttle program and found that the service is not doing as well as expected, but also getting a good deal of business attention.

Survey Comments

The survey showed that passengers at far as in the West Coast found the shuttle through various sources, including newspapers and even through recommendation of ticket agents at connecting airports.

Comments of the survey respondents, according to MacLachlan, were almost entirely favorable. There were some complaints about non-acceptance of checks or no travel cards for night passengers in the first, but these were not of passengers are now accepted on the shuttle service.

However, almost half of the passengers put in flight with cash. Eastern actually installed specially designed credit cards, containing only dollars and cents for making the night transactions.

Respondents appear to favor the shuttle, according to the survey. Comments of the service rather than the fare, has been the chief attraction. MacLachlan and several concerns have suggested their people to use the shuttle when traveling between the points in service.

American West not checked some shuttle passengers and found the rate too favorable, with consequences the chief point stressed. Example a business man traveling from New York to Boston, who normally uses Eastern for service but was trying the shuttle on the recommendation of friends, also business connections, who had used it

The businessmen liked it and planned to continue using it, he appreciated the convenience of simply coming out to the airport and getting aboard, without the bother of a reservation but with assurance of a seat.

Efforts to publicize the shuttle were not hampered by the use of a backup airplane on the first day of service to transport one passenger, who was the first to arrive for a flight and to could not be accommodated on the 93 passenger regular flight.

Public Acceptance

MacLachlan said the shuttle has been successful in terms of public acceptance rather than had been anticipated. It had been felt that getting across the idea of the service would take considerably longer.

The Eastern official said the new hourly service was doing a lower load factor even prior than the less frequent service.

No additional ground personnel are required, and, least backup airplanes are needed on some peak flights. Three airplanes have been needed and the backup one problem is severe. The additional schedules may smooth out these peaks to some extent.

An Eastern survey of its "airbus" program—that is another type of scheduled fare service offered to Florida from Cincinnati, St. Louis and Pittsburgh—showed that almost 44% of the passengers had been diverted from ground transportation.

The shuttle service percentage is less than that, MacLachlan said, but a "tailwind" the survey showed. He believes that the percentage of business diverted from ground transportation will increase growth in the future, but a good percentage of the shuttle traffic always will be composed of business travelers. Eastern plans to press for righting and assistance given in an effort to expand the market. School children visiting Washington from New York and most groups are examples of this type of potential business.

The shuttle service has also drawn some of Eastern's own ill-fated Boeing 707-100 traffic. MacLachlan said all shuttle flights save Los Angeles, but not very much.

Since regularity of service is a major selling point in the shuttle service, Eastern has been making every effort to achieve top on time performance with the operation. From the beginning, Aug. 10 through Aug. 3, on-time delivery record for the shuttle was 91.5%, and departure rate more than 15 can, late was 45.2% of the total. These figures apply to scheduled departures.

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The shuttle service, which currently handles 12 aircraft and 35 crews, is treated as a separate operation in many respects. For example, dispatches are handled separately from Porter's other services. A control dispatcher at Idlewild is linked directly to La Guardia, Boston and Washington. When the shuttle service comes into operation, they are treated by and from Porter's Miami line as right conductors.

Another strong asset of the shuttle service is baggage handling which gets a part-doll of expense. Gatekeepers deposit their bags on carts at the gates or dispatches, without climbing a baggage train. Then often a male or female to get the bags to self check counters before the passengers leave.

Claims for lost and damaged bags in the shuttle are to the actual volume of claims for the airline's overall operations.

As part of the effort to make departures perfect as much as the arrivals, in possible scheduled departures are started shortly before departure time. Last minute passengers board while the two engines are turning over.

Perishables Rotting At Moscow Airport

Moscow-Stalin is having trouble getting extensive capabilities to market efficiently through prescribed channels.

Airline cargo personnel here have complained that large quantities of fruit and vegetables from the Soviet capital from various areas of the USSR, as pending at Vnukovo Airport because they are not packed up promptly by state-run trade organizations in which they are consigned.

The relief workers noted that fruit is frequently found from the airport to Moscow at less time than it takes to move from Vnukovo by the city's streets.

When an complaint to the chief of the Moscow Civil Trust and Vnukovo Administration, he replied that he wasn't aware of the problem and, besides, he had never taken things on his mind.

"A telegram to the Minister of Trade of the Soviet Republic would soon announce," the official would defend.

Meanwhile an Aeroflot passenger has provided that point, multiple cargo in fruit perishables from Idaho and the Cayman Islands to Krasnodar, are conducting such a flying business that trucks can't load their places until loads of oranges and pineapples are unloaded from the cargo. He said that the perishables have their own way, as well as having that Aeroflot's own trucks with the flight perishables from the airport to the airport.

New Bonanza Fares Boost Traffic; Special Group, Flat Rates Proposed

By Russell Hawker

Los Angeles-Bonanza Air Lines officials report that customer has begun since April have produced an upturn in traffic volume, and profits and more school passenger traffic will soon be added to the line.

Bonanza expects to introduce an extra fare plan this fall which will offer passengers negotiating out of the Mississippi Unlimited travel over Bonanza's route at a flat rate of \$55 for 15 days or \$180 for 30 days and also has now reduced selling youth fare plan school tickets.

After three months of experience with maximum fares Bonanza reported this month:

- Total departing traffic for April (from 1961) was up 76.1% over the same period last year. The single month of June was 235% better than the period in June.

- Traffic in the markets being offered maximum fares was up 121% over the same quarter last year. June alone showed a 112% increase.

- Bonanza offered a round excursion plan and a combined excursion plan. The second excursion plan produced the biggest effect in the markets offered it—169% for the second quarter and 260% for the month of June. Traffic between conventional excursion points was up 65% for the quarter and about the same for the first three months.

- In markets not being the excursion fares, traffic was up 117% for the second quarter. This is considerably better than the experience of last service air companies for that period. Bonanza explains that traffic increase in the excursion markets was partly due to an increase in non-excess one markets. One of the chief benefits expressed about passenger traffic has been that they are not direct traffic which would otherwise have to be carried from Bonanza offices to these first service service such flights. About 42% of the traffic in excursion markets paid extra one fare.

Under Bonanza's Civil Aeronautics Board-approved youth fare plan persons between the ages of 12 and 22 can travel half fare if they have purchased an air youth identification card and \$2. Bonanza Executive Vice President C. Robert Hertz said the fare experts recommend, and wide use of the fare by students on summer vacations and summer break at the airline's headquarters.

Bonanza is also planning a low "senior citizens" fare for people over

65 and special rates for groups of people over 65 and special rates for groups of people traveling together. The line has been offering reduced rates to churches for some time.

Bonanza President Edward Converse said that he believes the success of the current effort to gain that airlines had nearly passed themselves out of business by four-fold increases in the past two years. Bonanza officials are convinced that the other passenger lines going into effect will prove competitive. They are also making advances in the summer markets have been made up of people who would not have traveled in air at similar rates and therefore were not satisfied from the traffic of competing lines.

Despite an increase in the number of seats available while the airline market, reduced in DC-7 fleet with Fairchild 125s, Bonanza's load factor rose from 47% to about 47%. Then said Airways A was noted he expected the market would be the value to be reduced in the near future and said there is hope it will be the first level service to clear the market completely. While he disavowed any being trend by stockholders, there was the line in making a profit check as yet about a few years on investment.

New Routes

Bonanza is building for new routes in the Pacific Southwest area. Local Service Co. according to Hertz. Important new routes which the company hopes to add would extend service from Nevada into the San Francisco Bay area.

The company would also like to have direct service between San Francisco and Los Angeles, according to Hertz. Since the line is not looking for much a profit, it is noted that it is not such a route with a direct service providing this service.

The boldness of Bonanza's new traffic in the area, plus its unusually "senior" Bonanza fare. It's another use of the line's money for a flat rate, is, it's actually being under the Civil Aeronautics Act but Bonanza officials are confident CAB will reduce all its past profits and grant an exception to that rule. They also said that it is not such a route with a direct service providing this service. The one rule plus would be introduced for one year in its experimental basis to see if it is possible. They said the experts are reasonably confident from the plan but not in financially high one.



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SHORTLINES

- **Bonanza Air Lines'** passenger holding time's Club ends for us, then its cheap transportation on any of the airline's flights
- **Chase**, a long-range radio navigation aid, is being installed by Federal Aviation Agency at Miami. The \$575,000 installation, to be in operation this fall, will assist navigation in the North and South Atlantic, the Caribbean, and off the U. S. East Coast
- **Federal Aviation Agency** is proposing an amendment to the Civil Air Regulations that would place the responsibility for keeping international persons all aircraft with uniform general personal and class amendments rather than with the pilot
- **Lake Central Airlines** reports a net profit of \$7,144 for the first nine months of 1961 compared with a \$77,450 net loss for the same period last year
- **NAMA** Flying Club members in Alaska will no longer have to be 16 years of age to qualify for a U. S. private pilot's license, by permission of Federal Aviation Agency. Reason: The club is only 62 in. long and its airports only 40 in. apart
- **Pan American World Airways** will begin nonstop service with jet equipment between New York and Antigua, Barbados, West Indies, on Dec. 16. Six days later the flight will be extended to include service to Port-au-Prince, Guadeloupe, French West Indies
- **Scandinavian Airlines System** will begin two DC-8 jet flights weekly from Copenhagen to Tokyo via Karachi, Bangkok, and Manila on Sept. 28. One flight will end at Frankfurt, Zurich and Rome, the other at Düsseldorf, Zurich, Rome and Casca. The DC-8 will replace DC-7Cs now used on these flights
- **Texas World Airlines** is constructing new landing gear at New York's Idlewild Airport to eliminate the danger of piled snow damaging jet pods on the ramp area. The job will be completed with portable heat generators capable of melting 25 tons of snow per hour
- **U. S. scheduled airlines** will be grounded for 12 hr beginning Saturday, Oct. 14, and extending into Sunday Oct. 15 during Sky Shield II, a North American Air Defense Command exercise to check the North American air defense system as a whole

AIRLINE OBSERVER

- **Nashville** **Habib** **Federal Aviation Agency** information will serve as the basis of a sharing committee created to sponsor a six-month study of international air transportation in a private consultant. Committee includes representatives from the Civil Aeronautics Board, Defense Department, Commerce and other government agencies. The study, plus an outcome of a recommendation in the Project Review report, has been endorsed by some industry officials who feel that more control is too short a time to cover all the complex problems facing international air transportation. As of late last week, the committee had not chosen a consultant firm to handle the job.
- **Domestic** **trunkline** traffic continued to decline in July while available seat miles again rose to pull the industry's loadable load factor to one of the lowest levels in recent years. Passenger revenue index for the month dropped 1% to 2.56 before. The industry has reported passenger revenue index again is only one of the most since 1954. Available 19% during the month to reach a record high of 4.75 billion. Load factor, which has dropped steadily virtually every month since 1954, reported again rose into service in September numbers, left 6.16 percentage points to 55.75%. Industry load factor has moved above the 60% mark in only one month of the last 10.
- **Radio** **light** **duplex** and **area** **communication** system will be installed at Idlewild, Newark and La Guardia airports by Instrumental Electronics Corp. to provide pilots with radar weather information. System will display cloud formations and general weather conditions up to 230 mi. from the New York airports.
- **Wings** for **TWA** to show across interest in the General Electric CJ405-25 jet engine for its prospective **Caravelle** order. Since the order has been deferred (AW Aug. 14, p. 42), the GE engine becomes competitive on a lease basis.
- **Eastern Air Lines** will introduce across transatlantic routes the next few months designed to improve scheduling and generate a higher volume of first-class traffic.
- **Air Transport Union** and the **National Aeronautic Association** have developed a program which will enable U. S. airlines to register speed records set on regularly scheduled flights with the Federation Aeronautique Internationale. At the present time, there are no official speed records of U. S. airlines reported with IAI, although five foreign flag carriers have reported records on file, including Quebec Express Airways with the speed record between San Francisco and New York.
- **Federal Aviation Agency** is studying the potential of the helicopter as an airport bus service vehicle. Agency is showing interest in the Kaman H-43B Huskie for this purpose.
- **Seat capacity** of **International Air Transport Association** members rose 4.7% during the second quarter of 1961 over the same period last year on North Atlantic routes. Total number of passengers scheduled only 4.9% in the same period resulting in a 20.6 point drop in load factors. Economical passengers accounted for 40% of all traffic. Of the 300,277 passengers carried on the route during the three-month period, only 72,277 flew first-class.
- **Washington** **Bellevue** **Helicopter Airways**, an applicant with the Civil Aeronautics Board to provide scheduled helicopter service in the Washington area, now has a paid-in capitalization of \$1,575,000. Contract and charter service has been started with a Bell 47H helicopter.
- **United Air Lines** **San Francisco** **passenger** **fly** **between** **San Francisco** **and** **Los Angeles** **no** **concurrently** **from** **San Francisco** **on** **other** **routes** **that** **the** **carrier** **has** **installed** **a** **signal** **in** **the** **forward** **galley** **which** **displays** **shaded** **and** **unshaded** **cockpit**. **And** **must** **wait** **passenger** **ask**, **for** **a** **second** **waiting** **during** **the** **flight**, **two** **seats** **are** **automatically** **swapped** **each** **other**.

Cuba Returns Electra; Right to Search Asked

Washington-Eastern Air Lines has asked Mexico to return the Cuban government's last week after an exchange of diplomatic notes and the return by the U.S. of a Cuban patrol boat attacked by a U.S. firm for non-payment of debts.

Conspicuously, mentioned in press for legislation aimed at averting further legal incidents, while the airline strengthened security measures and sought Civil Aeronautics Board authority to subject inspection personnel to personal search.

Imprisoned at Miami since its July 24 departure by a Miami writer, the four engine Electra was reported to have "suffering from conditions" in a 10 day Eastern tour which flew the aircraft to Miami after a thorough inspection. Very few agreements were needed. The Electra was stated to be a reliable good and flown to Cuba. Eastern maintenance officials and the Electra would undergo a major search examination in Miami and probably would be returned to scheduled service by then week.

The Cuban patrol boat was released after the Home Advertising Agency of Miami agreed to let it go "in an effort to demonstrate national unity." The agency has asked 10 Cuban aircraft and sold out of them within a federal court order granted because of unpaid Cuban debts.

President Kennedy recently signed orders in dealing with breaching regulations and postal out that most 25 Cuban aircraft have been brought to the U.S. by detentions. Porters of the aircraft have been examined and none sold.

These Commerce Committee members have reported out their version of a bill on hijacking which is expected to be presented on the House floor this week. The bill is more detailed than a version passed by the Senate but both carry a unanimous life sentence for it.

MEA Cuts Taxes

London - British Overseas Airways Corp. has agreed to sell an 89% interest in Middle East Airlines in MEA for \$5.1 million and the Lebanon airline recently is making arrangements for equipment of about \$5 million in loans.

Financing has been undertaken by a group of Lebanese banks. MEA has been a KAC-owned company since 1954 and has not received a profit. Financing agreements between the two airlines will continue, according to Sir Matthew Strickland, KAC chairman, and Sheikh Neph Al-Nahhas, MEA chairman.

planning provisions that could impose a death sentence if dangerous weapons were used. A joint conference may be needed to settle a bill except risk to both houses.

Meanwhile, the Civil Aeronautics Board granted Eastern Air Lines, National Airlines and Midwest Airlines permission to ask passengers to submit to a personal search in cases where the subjects suspect weapons are being carried.

Other airlines were expected to request the same authority to protect themselves against such action that might result from the screenings.

TWA Completes 707 Finance Arrangement

TWA World Airlines completed agreements last week for sale of \$107 million in 6% equipment mortgage making four notes to institutions and \$40 million in 4% equipment rent for sales to banks in domestic markets of 10 Boeing 707 111B and six 707 111B turboprop-powered transports.

The agreements followed closely the syndicate that TWA had filed last week. Boeing, Hughes and Hughes Tool Co. offering interference with the airline's efforts to complete the 707 financing (AW Aug. 14, p. 41). Changes that TWA might pass for a temporary suspension to prevent such interference followed closely with the signing.

TWA said there was no connection between the filing of the suit and the completion of the financing. Generally the new group of institutions and banks participating in TWA's earlier jet financing last week also are participating in this one though at present they have been. Delta, Road & Co., United Fruit and Lehigh-Burns were the investment banks representing the syndicate.

Grace Denies Any Plan For Panagra Merger

Washington-Carnegie industry opinion that a merger between Panagra and Brazil Airways will be a major outcome of the forthcoming Civil Aeronautics Board investigation of South American routes (AW Aug. 14, p. 47) is being called into question by W. B. Grace & Co., which holds a 10% interest in Panagra.

Grace last week said it would oppose any merger and claimed that the Board could call for the investigation did not suggest, even by implication, that the Board would make a merger between the two companies is a matter of acquiring the South American route problem.

In its order the Board said it had tentatively concluded that South

America should be served by a West Coast and East Coast route from U.S. gateways, each by a single U.S. flag carrier. At the present time, three U.S. carriers—Pan American World Airways, Panagra and Braniff—provide major service to ports in South America.

The Board specifically stated in its order that "power granted the Board... do not include authority to compel merger, or to terminate the status of a carrier." However, the Board can exercise its power over the economic stability of an carrier by strengthening the routes of use to give it a competitive advantage over the others.

The investigation was intended to determine "whether the public convenience and necessity require that the Board should modify the certificate or conditions of all or any one of the three carriers in order to implement the route pattern proposed for South America."

Swissair Plans 880 Far Eastern Service

Zurich-Swissair is scheduled to begin jet service to the Far East on Sept. 15 with two Concorde 340 transports on leave pending the arrival of the long-range Concorde 900 on order.

Both 880s on leave from Concorde were to be in Europe by late last week. Before leaving Europe, they will be used for cross training from Zurich to Airline System's Atlantic Airport near Stockholm. Previously of Kloten Airport prelates took training from Zurich.

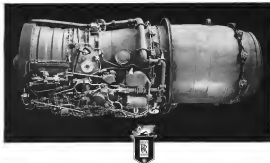
EAL Deficit Traced To Engineers' Strike

Eastern Air Lines last week announced a net loss from operations of \$500,000 for the first six months of 1960. Operating revenues for the period were \$145 million, a 2.5% increase over the same period last year, but operating expenses climbed 3.7% to \$151.4 million.

The airline said that the application of a special credit of \$5.3 million after taxes, representing a refund from the Internal Revenue Service, was the major factor in the company's continued maintenance revenue is related to a net dollar change of \$1 million to current surplus in the period. The airline's operating loss was primarily due to a loss of approximately \$5 million in revenue caused by the strike of flight engineers in February together with general business conditions affecting the entire industry, Eastern said.

Eastern held an available seat index during the period to a 15% increase while service passenger miles fell a slight 0.2%.

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THE JENNY VS. PANCHO VILLA

Blinded by stinging sand, the angry Mexican crowd raised also the American Jennies, leading them as the two planes took off. Moments before, the Mexicans had slashed the fabric of one plane and burned holes in the fabric of the second ship with cigarettes.

Seconds after itself, one of the Jennies was in trouble. The top section of its fuselage blew off, damaged the vertical stabilizer and forced the pilot, Lt. Herbert A. Dargus, to bail. As his companion, Lt. J. E. Garberry, landed a short distance

away, Mexican military guards hurried to protect the downed American from another menacing mob. By 8:30 the next morning the damaged Jenny was repaired and both planes were heading back to their base at Casas Grandes.

It was April, 1916. At the height of the Mexican Punitive Expedition against General Francisco "Pancho" Villa, the Jennies had completed a mission to deliver important dispatches to the U.S. consul at Chihuahua City in northern Mexico. Capt. Benjamin D. Franklin, the Army's first aviator, flew with

Dargus. Capt. Toward H. Dodd flew with Garberry. As a safeguard, each of the senior officers carried duplicate the patches.

The punitive expedition, led by Belg. Gen. John J. Pershing, had been ordered by President Wilson immediately after Villa's 465-man bandit army had pillaged the town of Columbus, N. M., 30 miles from El Paso. The First Aero Squadron at Fort San Houston, equipped with eight serviceable Curtiss JN-3 training planes, was sent into action in March—two weeks after Pershing had received 19 American prisoners in a train holdup near Chihuahua City. The squadron, with Captain Franklin as commander, joined Pershing's forces at Casas Grandes to begin the first reconnaissance flights over Mexican territory. By early 1917 Jennies from the First Aero Squadron had flown 543 sorties covering 10,000 miles. In August, the squadron left for Europe to attain a notable World War I combat record.

The Curtiss Jenny was the most important training ship of the war—and the greatest Jenny of all was the 20-40, powered by a 90-hp. Curtiss OX-5 engine cased in sheet aluminum. It had a top speed of 75 mph at sea level and a rate of climb that averaged about 2,000 feet in 10 minutes.

More than 4,500 Jennies were manufactured for American forces during World War I by Curtiss and seven other manufacturers. Hundreds more were produced in the United States and Canada for the English and British Empire air services.

Large government stocks of Jennies were cleared out shortly after the Armistice at auction prices as low as \$50. Jennies by the hundreds appeared all over the country.

In the postwar years, the Jenny became the first plane to fly a regular air mail schedule and was the first and most readily available private plane. In the hands of skilled pilots, the Jenny earned the title "Queen of the Skies."

Heritage of the Air

One of the most surprising chapters in the history of technical evolution is the story of the man and flying machines of World War I. It is the highly personal story of brave men—and the wood, wire, brass and rudimentary tools whittled that converted manpower to manpower. Today, Leach Corporation celebrates its 101st year in electronics with the presentation of this Heritage of the Air series.

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Technical Director for Heritage of the Air is Lt. Col. Kimbrough S. Brown, USAF.

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Self-Focusing Antenna Arrays Developed

By Barry Miller

Los Angeles—Futur approach to antenna system design which yields a new type of antenna called a self-focusing or adaptive antenna array, capable of quickly reconfiguring and locking onto and then automatically tracking a signal source, was demonstrated recently in laboratory tests.

The approach may provide the very high gain, perhaps in excess of 70 db, needed for applications in receiving radio signals from interplanetary space probes.

The technique involves the use of phase-lock loops, or electronic servo systems, which have been used occasionally in space telemetry systems, to automatically adjust the phase on elemental antennas in an array, so signal voltage picked up by each element can be added coherently, while the noise is added incoherently. While conventional antenna arrays seek, it accomplishes the same end, they require some type of programming to compute the phase shifts introduced into each element for steering waves in different directions and frequencies.

The natural systems design approach has been under study for the past two years in separate, independent efforts by two companies in opposite sides of the country. Recently, both established the feasibility of the self-focusing antenna concept in laboratory simulations. The two organizations are the Hughes Aircraft Division of Space Group Corp., 6801 North, N. Y., and Space General Corp. of Cleveland, Ohio.

Space-General is a new composite of its (AWI July 18, p. 79) combining America's Spacecraft Division with Space Electronics Corp., which has consolidated the adaptive antenna work.

Acquisitive Time Factor

Acquisitive times of the phase-lock loop array—that is, the time it takes to lock for and lock onto a target—are reported (inferred) from those of a conventional array, according to Dr. Arthur F. Gump of Space General. For a signal-to-noise ratio of approximately 1 db, the acquisition time of the phase-lock system is no greater than 0.6 sec compared with about 0.7 sec for the conventional array. Because the phase-lock system is adaptive, it can acquire a source more rapidly for higher level signals, Gump says. The conventional array, he points out, has a fixed acquisition time for the signals equal to or greater than the manual searching detectable by a conventional array. In addition, he says, the phase-lock system can acquire signals before the antennas detectable signal although it takes a longer time.

Other advantages of the phase-lock loop antenna array, cited by Gump, are that the system is:

- Adaptive to changes in antenna spacing
- Adaptive to changes in signal level and noise spectral density
- Capable of using the incoming signal to automatically and electronically calibrate the antenna array beam.

In addition there would not be any problems with aging or phase drifts or

antenna elements or phase differences arising when spacing between antennas changes.

Space refers to its phase-lock loop array by the name Africa (for Automatic Three-dimensional Electronic Steered Array). Studies in this concept's acquisition indicate that when high gain antennas are required, the phase-lock loop technique will supply it and at considerable less cost when a gain of about 60 db is required. Achieving gain in excess of 70 db, they say, will require additional techniques such as reflectors—enhancing mechanical structures on large dishes and phase drift compensations due to atmospheric inhomogeneities. Because they are both phase locked, automatic phase locked techniques as provided by the phase-lock loop approach can be used to eliminate them. A report on Africa was presented at the recent Global Communications meeting in Chicago.

One major benefit of the phase-lock loop approach, Space-General believes will be a structural fix breaking down the barrier between antenna design and transmitter/receiver design. With the gain of the antenna made possible in part electronically by the intrinsic of phase-lock loops between the receiver's main and all steps, antenna and receiver design become untied. The collapse of the antenna/receiver barrier between the two techniques could well have salutary effects upon both.

Study Support

Phase-lock loop antenna studies have been supported by several government agencies. Space General's efforts were sponsored in part by two small contracts one from the National Aeronautics and Space Administration's Jet Propulsion Laboratory, the other from the Air Force Cambridge Research Center. The former contract called for an investigation of the requirements and feasibility of an electronic, self-focusing, tracking antenna system while the latter organized a laboratory workshop to demonstrate the results of the former.

Space's work has been supported under a continuing Air Force study from an agency the company declined to identify but which is believed to be Route Air Development Center. The company says it believes the most promising applications for its Africa technology are in microwave power beaming, long-range target detection and tracking, communications with both

High-Gain Antenna Functions

Communications over planetary distances with space vehicles which do not have maneuverable amounts of power at their disposal and whose antennas are fixed in one place is being handled on ground receiving antennas. For receiving radio information (long wavelength) from spacecraft near Mars or Venus, systems with high gain—in excess of 60 db—would be desirable according to engineers at Space Group Corp.

Antenna gain—a measure of how well the antenna reflects radio waves from a single direction over a large area and hence it is a useful antenna—be realized in a number of ways. Three methods:

- Reflective antennas (parabolic dish)—Reflectors shape waves the length of all paths from the reflecting source to the receiving point or beam spot. At the focus, reflection from any portion of the dish can be in phase or coherent with reflection from other portions of the dish.

- Reflective antennas (dielectric lens)—Equivalent free space path lengths of all paths are equalized by causing waves to travel in some portions of the path at less than the velocity of light in free space. Rays are bent or focused to a single point, or reflection over large area is brought into phase at the focus.

- Antenna array—an increase in effective aperture (expressed in gain) can be realized in an array—a coupled system of antennas. Waves impinge phase shifts provided by mechanical or electronic phase shifters that effectively are true delays. Individual apertures can each illuminate antennas of the array can be delayed by a remote amount and then added coherently. The array's beam in one position at which desired apertures are added.

Each antenna type has its own peculiar problems in direct coupling when employed for area and track operations, according to Dr. Arthur Gump of Space-General Corp. Among them is that the relatively long time needed to acquire a reflecting source the possibility that a false indication of source direction will be given if the source is acquired on a false lobe, the high degree of mechanical precision in tolerancing delays in the feed to program an antenna array with some type of computer and the relative inflexibility of the systems in operation.

Different techniques can be used to enable the system to lock in different directions. Parabolic reflection at their third points can be moved but the nature of moving gain toward requires loads on search times. Or the beam can be pointed between a

number of fixed feed points. Moving numbers of feed points leads to interfere with incoming radiation, however, Gump said. There are only a finite number of directions for the beam and it must be moved as the beam is shifted.

Steering of the beam can be changed continuously, in a discrete line system by moving feed points, but use of mechanical system isolates rapid scanning or beam pointing. Many feed points can be employed without blocking incoming radiation, but less gain. Gump points out, the beam can be moved only in time and in a discrete number of directions.

Beam, reflector and dielectric lens systems are either limited in speed due to relative displacements of mechanical system or as they have structural stresses.

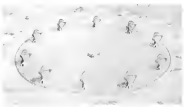
Antenna arrays risk, in mechanical phase shifters, electronic phase shifters such as ferrite shifters, phase-shifting units and frequency scanning. They can be made less without gain process in total configuration, Gump says.

Although they have faster response, phase shifters introduced at each element antenna must be computed for each direction and frequency of an incoming wave. Phase shifts are a function of the spacing between antennas, so changes in spacing cause errors. Aging or temperature errors into the array elements, depending the narrow beam.

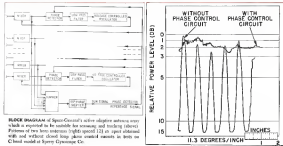
Frequency scanning is rapid but uses a particular frequency can be used in one direction—disadvantage for communications systems. Frequency scan arrays must be constructed (usually to a higher degree of precision than a phase shift array since the latter's total error can be compensated and they require more and sometimes capable of covering the wide frequency band used for scanning.

A phase-lock loop array will adjust the phase of each elemental antenna automatically. Space-General says. Changing phase shifts electronically, makes rapid scanning possible.

An antenna system must be capable of locking onto a source by locating at beam pointed at the direction of the source. The time required to lock for and lock onto that source—called the acquisition time, should be short. Ability to move the beam rapidly and accurately plays an important part in acquisition time. The phase-locked array will have short acquisition times and be suited for area and track operations, Gump says.



ARTIST'S CONCEPT of an array of parabolic antennas as part of the Africa concept (Africa stands for Three-dimensional Electronic Steered Array) which can provide high antenna gain needed for deep space communications.



BLOCK DIAGRAM of Space-General's active adaptive antenna array which is reported to be suitable for scanning and tracking (inset) Patterns of two beam elements (right graph 12) in array obtained with and without closed loop phase control systems in tests on C-band model at Space Group Corp.

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active and passive coupling, often hours of spare communications and stress phase needs.

Operation of the self-locking system can be illustrated by an incoming block diagram (page 35) of what Space-General calls its active adaptive antenna array system. At left, incoming signals, picked up by the directional antenna in the area, are mixed with signals from voltage-controlled oscillators.

Only two of many possible channels are shown.

The voltage-controlled oscillators are varied in frequency and phase by the signals from the phase detector until the signals from the mixers are all at the same frequency and phase, the comparison point.

These signals are then added in a summing network.

Voltage-controlled oscillators come to an average zero voltage frequency, and then assume the relative phases of the input signals. In this way, phase shifts introduced by different path lengths are adjusted automatically in these oscillators.

High-Speed System

Because the system is electronic it can be made very fast. Speed of acquisition is determined primarily by system gain and the bandwidth of the low-pass filter preceding the voltage-controlled oscillator. The bandwidth of the system is governed mainly by the rate of signal strength to noise spectral density.

According to Space-General, adjust-

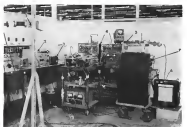
ing phases automatically by phase-lock loops are:

- Spacing between elemental antennas can change with time.
- Extension phase shifts introduced by elemental antennas by aging and other causes do not degrade the narrow beam.
- Source cannot be acquired on a side lobe.
- Spacing between elemental antennas need not be known accurately.
- Phase shifts need not be calculated as they must be in a conventional or open loop array.

System changes in bandwidth in response to the signal level, i.e., the large signal levels the bandwidth of the phase-lock loop rises, giving sharper acquisition times. Hence the system can be designed to automatically acquire signals of any level in the shortest possible time. It is this property of the system—the ability to shorten acquisition time as signal strength increases, thereby increasing bandwidth—which makes the system adaptive.

System can also be made adaptive to changes in noise spectral density. This is accomplished, Space-General says, with bandpass filters at the output of the system.

These devices can maintain the same signal-to-noise ratio in three outputs in as short a period. They also have constant output power. These relations enable the output signal to be effectively constant for high signal-to-noise ratios. When these ratios are low, output signal power is proportional to input signal-to-noise ratio. As increases in the noise spectral density



SELF-LOCKING ANTENNA test model in laboratory at Space General Co., Great Neck, N. Y. was employed in establishing feasibility of electronically adjusting phase differences at elemental antennas so they can be added coherently. Equipment includes: summing network (1), signal source (2), reference oscillator (3), power supplies (4), phase-locked antennas (5), dual oscilloscope (6), RF shielding material (7) and phase-locked loops (8). Tests were conducted at 5,650 mc. (C-band)

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with input signal power constant will give a smaller output voltage, thus lowering the gain of the phase-locked system and in turn reducing the bandwidth of the phase-locked system. Hence, in the phase-locked loop, bandwidth, a fairly constant signal-to-noise ratio will be maintained when the noise spectral density increases. This means, Space General says, that the system will acquire and track the source signal. The rms phase jitter in the voltage controlled oscillator will not rise when the noise spectral density increases, the company says.

To demonstrate the flexibility of the phase-locked loop system, both companies have built laboratory breadboard units. They differ in that the Sperry model was a two-loop system operating at 100 MHz while the Space-General model was an eight-loop unit at audio frequencies.

The Sperry model consisted of two phase-locked loops connected to open-ended waveguide radiators several wavelengths apart. A third horn was used as a target, or source. With the loops disconnected and the source horn transmitting, the open-ended horns were grounded and the RF signal in the loops were subsequently added, according to the company. A grating lobe pattern resulted in the signals as the two receiver horns added in and out of phase.

Then the phase loops were connected and the gain was shown to be substantially constant over the same angle of the wave. Deviations were attributed to reflections from metallic objects in the indoor test facility.

A transmitter was also connected to the Athens locked horns by means of an isolator and offset an frequency about 110 mc. from the received signal used to lock the phase loops. A receiver was connected to the target horn and a pattern was taken with and without the Athens loops operating.



Lockheed Antenna

Scatter plot diameter and field tracking antenna at Lockheed's New Boston, N. H., facility is used in connection with company's Deconvolver, Main and Source satellite programs for the Air Force.

Control and Instrumentation Engineers

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SCHEMATIC PHOTO of shock wave pattern at Mach 3, taken by United Aircraft Corporation supersonic wind tunnel, one of several advanced facilities used to develop Hamilton Standard variable inlet geometry controls.

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Space Guidance Methods Detailed by ARS

By Philip J. Elms

Stanford, Calif.—Astronauts the last few years rely on attitude control and guidance systems, expected to advance one accuracy with an error of less than 10 sec of arc was reported here during the recent Guidance, Control and Navigation Conference, cosponsored by the American Rocket Society and Stanford University.

The new 315-D tracker, designed to locate and lock onto stars of sixth mag outside and higher within a 50-deg cone of view is being developed by General Electric's Missile and Space Vehicle Department, Dr. R. S. McMonroe said. The device is expected to be operational within several months, McMonroe told Armstrong Weiss Tracker power consumption is expected to be less than 25 watts.

The more than 500 engineers and scientists who attended the conference also heard reports on the following:

- **Use of angular accelerometers instead of gyros** for attitude control. Angular accelerometers are dynamic instruments caused by bending mode deformations of the missile frame. Armstrong's Walter K. Jones and Joseph H. Jorgensen passed the use of multiple placed accelerometers whose signals are weighted according to vehicle mass distribution, then added to provide a direct measure of the force and torque acting on the missile which is independent of bending mode deformations.

- **Recent advances in cryogenic gas techniques** suggest that "one can have a super gyro within a few feet," said Propulsion Laboratory's John T. Harding said. JPL's cryogenic gas effort has been directed at researching large problems areas rather than attempting to build an operational unit. Harding said Measurements made on a gas with gyros built contained less than 10% error in phase and period to a precision of 0.0001 in, showed a total torque due to anisotropy including ions, which was of about two dyne-centimeters, with torque due to trapped magnetic flux of about 100 dyne-cm. Harding said JPL is investigating use of a light weight atom made of aluminum which is vapor-cooled with a superconductor to obtain surface, he added.

- **Inverted-locks type drag brake**, where braking can be varied (modulated) appears to be an attractive means for providing mass control functions for reentry vehicles. ARS's W. E. Van der Velden and J. E. Hays reported. The drag brake can be used to orient the vehicle while in orbit, adjust its reentry, and control the vehicle's landing point accurately. Additionally, the drag

brake can be used to dissipate energy by arriving at a large altitude, the Aero Institute reported. Because the drag effect will vary over wide loads due to corresponding variations in atmospheric density at different altitudes, the exposed brake area would be controlled from signals provided by an accelerometer on the vehicle to give the desired amount of deceleration at an instant during reentry. To provide precision control, the accelerometer would need to operate over a 2,100 to 1 acceleration range. ARS's research in modulated drag brakes was sponsored by USAF's Astronautical Systems Division.

- **Attitude with a "memory,"** called a "memostat," suitable for use in constructing artificial memory circuits for use in self-learning control systems, was developed by Robert Whitlow, Electrical Engineering Department, Stanford University. The memostat is a three-

terminal device in which the conductivity (memostat) between two of its terminals is a direct function of the time-integral of the current in the third terminal, rather than the instantaneous value as for a transistor. The device consists of a conductive substrate with insulated connection leads and a memostat made, all of an electrolytic plating bath. Memostats produced to date have a maximum current continuously available between approximately 1 and 100 ohms over a time interval of about 10 seconds with the application of several milliamperes of plating current. Whitlow said. At present, memostats are made by hand and 5 to 10 millifarad capacitors are used in parallel with the substrate to obtain a low-impedance output. Light coats of dielectric provide a smooth substrate for plating and protect the copper lead connections. These connections are welded and the substrates are sealed in individual copper plating baths in polyethylene cells. Improved techniques and configurations for making memostats are under investigation. Whitlow said.

- **Optical doppler optics** for determining space vehicle velocity by measuring doppler shift of sunlight was the subject of several reports at the conference. R. C. Franklin and D. L. Durr of Franklin Institute Laboratories for Research and Development said that changes in velocity of about one kilometer per second had been measured in the laboratory using telescope spectroscopy and that it may be possible to measure this sensitivity by a factor of 100. A more attractive technique for measuring doppler shift of sunlight, suitable for measuring velocities as high as 10,000 meters/sec, at the rate of optical frequencies possible with optical systems, the authors suggested. A system using optical memory would use bandpass equipment for the detection elements, then would be used for a high-frequency oscillator and massive optical wave problems. The Franklin Institute studies were sponsored by USAF's Astronautical Systems Division. R. N. Norton and R. L. Walker of Jet Propulsion Laboratory were less optimistic over the possible use of such an optical doppler system. Their investigation of time-sharing and shifting mechanisms in a stellar atmosphere (including the sun) indicated that a wavelength of about 200 Å might be expected in an observer's measured optical doppler velocity, in addition to errors or limitations of the measurement itself. It is this which suggests a fundamental limitation on the accuracy of a solar doppler velocity system.



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Small Telemetry Unit

New USAF Dryden telemetry system for small research rockets, weighs only 12 lb including 3 lb. of batteries. System developed by Space Electronics Corp., is expected to achieve ranges of at least 300,000 mi using 1-watt transmitter through use of extremely efficient digital coded transmission. The system includes phase-modulated transmitter, fully transistorized and weighing 7 oz. It is made by Vector Manufacturing Co. System's first flight will be about a USAF Blue Scout Junior rocket later this year to measure telemetry in space.

after their instrumentation, the motion behavior.

• **Path-adaptive guidance mode**, developed for the Saturn space vehicle to accommodate loss of one or more engines during flight and to provide greater latitude of launch time for difficult space missions now described in two reports by W. K. Mase, D. H. Schweitzer and N. J. Bond, all with the George C. Marshall Space Flight Center. In the path-adaptive guidance mode, a digital computer aboard the vehicle will compute the best three-vector alignment required for the optimum path from the launch vehicle coordinates to the desired mission conditions, based on the measured performance parameter. Vehicle will then be steered to correct the error between the measured thrust vector direction and the computed value.

• **Attitude control of space vehicles** using earth's magnetic field, for vehicles where long lifetime precludes use of non-depleting systems for dumping reaction momentum, was described by R. G. Buckingham of Westinghouse Electric's Air And Space Division. Vehicle would be equipped with three constant-permeability rods for transferring momentum and three variable-permeability rods which for zeroing momentum and generating desired angular motions. Unbalanced momentum stored in north coils (from previous maneuvers) would be removed by techniques generated from the shafts to provide signals proportional to magnitude of momentum. A magnetometer would

measure components in three orthogonal directions of the earth's magnetic field. A simple analog computer could then determine how much current must be supplied to each coil to develop required momentum transfer torque. For vehicles operating at altitudes below approximately 40,000 mi, where an operational loss of more than second works is required, the electromagnet system described is lighter and occupies less volume than non-depleting systems, Buckingham said.

• **Force stabilization** of space vehicles in highly eccentric orbits in an earth-vertical well prove extremely difficult due to the complex kinematics of the problem, Dr. Paul H. Stern of Amman, Conn. Bosch Army Corp. reported. His analysis indicates that the vehicle will oscillate, at three different frequencies. Satisfactory frequencies of the forcing function (rotational frequency) within the orbital plane and a rotational frequency perpendicular to the orbital plane.

• **Stable orbitations** previously is another source of perturbation for space vehicles. R. J. McElroy of Space Tech. Inc., Laboratoire said. Results of an STC analysis indicate that orbit reduction maneuvers are preferable compared to an either periodic or constant with respect to orbital space depending upon the orbital inclination of the vehicle relative to the orbital plane. The

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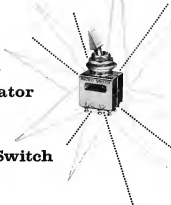


Flip-Flop Circuit

New monolithic flip-flop circuit, consisting of 12 uncommitted components each presented in silicon oxide film and mounted on ceramic substrate measuring 0.31 x 0.31 in. available for use in space/RCA Micro Modules is now available from General Instrument Semiconductor Division. Each flip-flop consists of six uncommitted elements, two silicon diode connected, two resistal phase functions and two fast-switching phase inverters. Components are interconnected by gold plated circuit. Device is called a "monolith." Company's address: 65 Governor St., Norwalk, N. J.

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Circle 15, 1980 Reader Service, 1980

combination requirements and the vehicle's configuration, McDonnell and • **New approach to guided air attitude control**, designed to measure propellant consumption yet provide stable control without need for jet signals, was reported by R. S. Geyl and W. N. Kuller of Space Technology Laboratories, Inc. The system employs a jet signal to sense the movement on time of the propellant flow. The system controls vehicle attitude by jets, changing according to error limits and damping the motion in a non-linear fashion by using photoplastic speedup information only. The knowledge of the quadrant is obtained by using the characteristic of the phase plane that an increasing error magnitude defines the first and third quadrants. That with of the error is increasing in magnitude should control action be taken, the action is.

******* FILTER CENTER *******

• **USAF to Expand Electronics Effort**—Air Force Systems Command's Electronic Technology Laboratory, which funded more than \$1 million in electronic programs in Fiscal 1981, hopes to double the effort in the coming year. If developments are under way, those expected programs Air Force may expand its electronics program in several hundred per cent during Fiscal 1982.

• **USAF Divides Infrared Responsibilities**—Within the next 60 days, Air Force Systems Command's Air Force Directorate will assign responsibilities for applied research in infrared detectors. Reconnaissance Laboratory will be responsible for infrared detectors as applied to use at wavelengths shorter than 100 microns, while those for use at longer wavelengths will be assigned to Navigation and Guidance Laboratory. Air Force Directorate's Electronic Technology Laboratory will monitor programs in new infrared detector materials.

• **Ready VOR Has Self-Check Feature**—New Navy A-10 navigation receiver developed by Bendix Radio has built-in circuitry which enables pilot to check its operation in flight. When pilot pushes test button, VOR indicator will display status bearing of zero degrees if equipment is operating properly.

• **UML Computer Checks Autopilot**—New analog computer has been developed by technicians at United Aircraft Systems maintenance base which can check dynamic performance of an autopilot in 30 days or less. Favorable static testing of malfunctioning autopilot required as long as 5 hr,

and did not allow that autopilot would function properly in flight. Dynamic performance of airplane and associated systems is recorded on a Bosch autopilot recorder.

• **New SHF Magnetron Developed**—Voltage tunable backward-wave magnetron with a tuning range of 10.5 to 11.5 GHz, has been developed by Sylvania under sponsorship of Electronic Technology Laboratory, Dayton. New tube provides approximately 100 watts of cw power output.

• **High-Speed Movie Camera Developed**—A mean picture camera for filming and timing high-speed motion simultaneously in color and black-and-white, recording single frame action at 20 kiloframes of a second while taking one picture frame per second, has been developed by Naval Ordnance Laboratory, Silver Spring, Md. New camera, 15 times faster than high-speed camera now in use, according to NOL, was developed for Atomic Energy Commission to be used at Lawrence Radiation Laboratory, Livermore, Calif.

• **Interrupt Radar Speeds Reloading**—Interrupt fire control radar on the Navy's (McDonnell) F-15, which recently broke previous transcontinental speed record by flying nonstop from California to New York in 2 hr 48 min, cut radar reloading time in half by prepositioning location of AID radar targets, according to Westinghouse Electric, whose Air Arm Division developed the fire control radar. New Westinghouse radar has greatly improved range over previous radar systems, the company says.

• **Physiological Data Acquisition—A** reliable data acquisition system which will gather physiological data from an instrumented man or change located in an environmental chamber at Holloman AFB will be built by Sparolite, Inc. System which can gather environmental as well as the physiological data will include magnetic recording devices, analog-to-digital conversion gear and display console.

• **Four subsidiary companies of S. Smith & Sons (England), Ltd.**, have been merged to form Smith American Division, with headquarters at Wrentham, Massachusetts. Companies are Smith Aircraft Industries, Kelco & Hight, Wrentham Group & Instruments and Kelco & Hight (Aircraft). Offices are: R. Gordon Smith, chairman, L. A. Morgan, general manager, L. M. A. Morgan, deputy general manager, L. C. Harlow, chief executive officer, Wrentham, Massachusetts. Director D. G. Johnson has been appointed chief technical sales executive.

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• **Brusture - temperature transducer**, Model 2370, for measuring temperature inside or outside vehicles and shock specifications of MIL-E-6212C. Transducer measures 1/8 in. x 5/16 in. x 4 1/4 in., will provide continuous operation from 50 to 1,500°F, and



can be installed with unflashed vacuum bases. Resistance of platinum sensing element is 100 ohms at 77°F. Manufacturer: Waco Instruments & Controls Co., 11709 W. Pico Blvd., Los Angeles 64, Calif.

• **Voltage/phase comparison**, Model SPN-400, constant cathode ray tube and precision reflector for accurate measurement of phase shift and voltage ratio. Self-contained and occupies 5 1/2 in. of panel area or can be employed



in portable unit and has a variety of applications with a.c. signals or steps from 25 cps to 10 kc with measurement accuracy of ± 0.1 deg. Manufacturer: Avionics Division of North American Aviation, Inc., 9170 E. Imperial Ther., Downey, Calif.



• **Micro transducers**, including models with balanced four winding design for differential input parallel circuit isolation or other instrumentation. Custom input made to order as available. Manufacturer: Jenco Electronics, Inc., 4600 No. Roosevelt St., Chicago 18, Ill.



• **Magatron**, IEM-571, a Ro-hood pulse unit for airborne radar testing, provides 100 lbs. of peak power at a 4,000 duty cycle. Frequency range for the tube is 15.9 to 16.1 gc. Pulse duration is 0.06 to 1.2 microsec. Input/output terminals may be connected to 10 pins. Manufacturer: Bessie Laboratories, Inc., Schaumburg, Ill., Schaumburg, Ill.



• **Triaxial potentiometer**, produced by differential action of an oxide of high temperature on a glass substrate, thereby providing unit with superior resolution. Potentiometers have constant resistance range from ± 0.1 to $\pm 150\Omega$, can withstand 100 shock and 70g vibration from 20 to 2,000 c/sec. Temperature coefficient is 50 parts/million/degree C. Manufacturer: Instron, Inc., 50 So. Schenck Rd., Santa Barbara, Calif.

• **Automatic machine/analogue tester**, Model CO-1811-001, will automatically test 50 and 600 cycle machines or modules from MIL-STD-88 through 17. Tests include no-load quadratic moment ($\pm 1\%$), no-load reference current ($\pm 1\%$), fundamental and voltage ($\pm 1\%$), total rms voltage ($\pm 1\%$), fundamental rms ($\pm 0.1\%$), error from electrical zero (± 20 sec) and phase shift (± 1 deg). Tests measure 66 in. high, 47 in. wide, 50 in. in depth and weighs 1,800 lb. Manufacturer: Kester Division, General Precision, Inc., 1154 Melrose Ave., Little Falls, N.J.

In engineering and manufacturing AMF has ingenuity you can use.....



WITZ FLUGZEUG (above), technical director and chief designer of East Germany's Type 152 medium-range transport, led by the VEB last October after East Germany failed its design program. Photo was taken in time of 152 rollout in 1958.

East Germans Scrap 152s in Production

By Cecil Browder

Brown-Cordis Institute of East Germany's VEB, building a series of new, failed all in it turned a series in its design effort, now the bank being converted to the production of new aircraft as piston planes, prefabricated engines, landing and industrial aircraft. Completed prototype transport and passenger designs as well as a new fighter plane are to be scrapped to the same scrap heap as an under-performing series.

Witz himself, himself called to give solutions to East German hopes of developing a strong domestic industry stand up, along with related special money that cannot be applied to other projects. Aeromedical engineers in governmental order are during that attempt to make frames instead of airplanes.

Several last commercial success, decision to lift all aviation design, development and production activity (AWR Mar. 27, p. 26) came at a time when even maintenance of the Type 152 four engine medium-range jet transport, first single model of the East German drive to gain international status in the aviation field, was moving ahead at an accelerated pace and several more sophisticated models were in the drawing boards.

Components for a total of 28 Type 152s, for which a new and expensive industry had been built almost from scratch, had been or were being built at the time of the crash. The

second prototype, incorporating second design changes over the first, was following its flight test schedule and a third had completed the major goals in its design program.

A fourth aircraft was in the final or sixth stage of the third round aircraft enterprise, VEB Flugzeugwerke Dresden when Peter Fritzsche, the firm's technical director and chief designer, fled to the West last October.

Key Departure

At the time of Fritzsche's departure from Dresden, the backlog of the 44th aircraft was going out to its wings and tail while awaiting delivery of its four Peco G4-A1 turboprop powerplants of 2,945 hp thrust each from VEB Industriemaschinen Lutzschke near Berlin. Under the East German structure, Lutzschke was responsible for serial production of turboprop engines while their design, development and improvement was the province and responsibility of VEB Erdbebenflugzeug Peco near Dresden.

Prototype, wing and tailplane of the third aircraft also had been completed by the time and components for another 14 transports were being mass-produced. Overall, the Type 152 development and production program, through behind schedule, was made to begin divided projects, according to Dr. Fritzsche, who is now associated with West-Flugzeugbau GmbH here.

Initial deliveries to East German Deutsche Luftfahrt had been scheduled for late 1961 or early next year

and the government, working within its Soviet assigned sphere of relatively light transport design and low thrust turbine powerplants had hoped to break into the Western export market with the aircraft.

For acute production, the Dresden plant, which Fritzsche helped plan and build from the ground up, had two large 325-hp long manufacturing and assembly shops with seating in place and in operation at the time of the revolt.

In the West, at least the program had seemed to get off to an auspicious beginning when the first 152 prototype was delivered on Mar. 4, 1958, during its second flight from Dresden after a series of four had followed in a total less than the previous Dec. 4.

Fritzsche, however, anticipates the crash, at a point about five miles from the Dresden airport, so pilot crew a stall at an altitude of approximately 1,000 ft from which the pilot was unable to recover and was unresponsive to the second aircraft had been placed well before the accident. The prototype it fell on a complete loss, including no impact on Fritzsche and his associates involved from the plant.

The second prototype made its initial flight on Aug. 16, 1958. The second and last flight before Fritzsche left followed on Sept. 4. The flight test program, however, is believed to have continued in the time it was ordered to a halt by the government.

Meanwhile, to the second prototype included a sponsorship of the main landing gear structure and dimen-

sion of the main engine wing structure on each wing. In the first prototype, a heavier fuselage had been extended and attached into the rear fuselage section with a forward two-wheel large beneath the nose. In the second, the nose fuselage gear was replaced by two wheels located in each wing in a pod to the rear of the underwing engine pylon at a point between the exhausts of the two Peco engines (AWR Mar. 21, 1958, p. 76).

While the prototype cost was not documented, its wing loading probably was reduced, probably to avoid any major design modifications that might have been necessary to prevent further loss after being received. The nose section retained the role of its first model with each wing approximately 160 U.S. gal of fuel.

The glider was now active for the aircraft as the prototype's Dresden factory as Soviet design, but was clearly named on the second model.

The 152, with a 35-gal wing-high wing, was designed to carry a maximum of 75 passengers in a two-level layout configuration over a maximum stage length of 1,200 m or maximum range without reserves at 1,655 km. Cruising speed at 30,000 ft was 497 mph or, according to Fritzsche, while maximum speed at 15,750 ft was 573 mph.

Takeoff run at the maximum gross weight of 112,445 lb was 1,410 ft. Landing roll at a gross weight of 77,120 lb was 1,200 ft.

Possible Follow-ups

As possible follow-ups to the 152, where development actually was begun in Fritzsche and other German engineers in 1954 while they were still working in the Soviet Union, the Dresden plant had several new designs in the making—the most promising of them a two-engine low-wing transport intended as a replacement for Russia's clanking piston-engine Il-14.

Most initial design departure in the 44-passenger aircraft designated Type 155, was Fritzsche's plan to locate the two Peco G14-A1 powerplants in pods attached to the upper wing surfaces each at a point approximately 35 ft in from the fuselage. Design cruise speed of the straight wing aircraft was 415 mph, only a maximum range of 1,000 m. Several planned stage lengths were approximately 500 m.

At the time of Fritzsche's departure, the aircraft was still in the initial stages. A wingtip had been built and between 200 and 300 different drawings had been completed—was carried to the approximately total of 42,000 needed for the 152.

Earlier plans for a 70-passenger two-engine turboprop transport, the 153, of about the same general size as the 152 and also making use of Peco-designed powerplants were scrapped by Fritzsche

after calculations showed that with one engine out and a short concentrated propeller the aircraft would almost certainly be pulled into a steep loss by the torque of the working power plant and then fall into a steep, probably uncontrollable 40-deg dive.

Use of counter rotating propellers was one of the questions, Fritzsche and some design and production of the aircraft governing mechanisms was beyond the East German state of the art at the time. The project was not abandoned, however, until after 2,000 drawings had been completed and a number of test and test trials had to test out Fritzsche's ideas. Proposed powerplant was the Peco G15 with 1,400 hp.

Another Fritzsche design under consideration—the Type 154, a medium range transport somewhat larger than the 152 and with greater range and payload capabilities—consisted of two of four advanced Peco engines of 7,700 ft thrust each located in clusters of two, one above the other, on the rear of the fuselage near the tail section.

Designs and actual aircraft, including the proposed 154 which were broken up for scrap, but the state knew they had lost. Much several months after Fritzsche's departure when the East German government announced an abrupt halt to all aviation development activity in an effort designed to ease the spiraling

economic chaos within the country. Officials of the plants, which had been laboriously built up from ground level since 1954 on a crash, prestige basis, were told that rather than aircraft and engines, they would henceforth produce a series of goods designed to have an immediate impact upon the stagnating economy.

Practical Production

Dresden, Peco and Lutzschke moved to the design and production of more piston drive design with VEB Industriemaschinen Karl-Marx-Stadt, East Germany's third major aviation facility. Improved version of the Russian designed Aero 321-A piston engine for the 50 U.S. lb built under license at Dresden, between 1956 and 1959 were produced in enough the same time span at Karl-Marx-Stadt. Later the plant moved to the production of other components for Dresden designs, including the 153 turboprop system.

At its peak, the Dresden facility had a total of 9,000 workers, 1,700 of these engineers, and Fritzsche terms the design group working under him as "a good, but not standard, about 70% of the engineers were young Germans with an age span of between 25 and 35 who had received their education in the Soviet Union, Dresden and elsewhere.

The others, ranging between 40 and



WITZ FLUGZEUG (below), former technical director and chief designer of VEB Flugzeugwerke Dresden, explains his jet transport design to a group of East German officials shortly after the time of the second prototype of the now scrapped Type 152.

SOLID SUCCESS

On August 5, 1961, United Technology Corporation successfully test-fired the nation's first operational prototype segmented solid propellant rocket developing thrust in excess of 200,000 pounds. This major achievement is a significant milestone in the national program to develop multi-million-pound thrust boosters.



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LDB-5100 tunnel shown at left had a maximum speed of 150 fpm

14 is age, had worked in Germany before and during World War II, as had Froying, a dual citizen engineer at Jukov in Dessau from 1916 until his capture by the Soviets in 1915.

Donald, the East German aviation industry had offered an employment figure of approximately 25,000 shortly before the government itself, assuming a moderate number of the country's had-to-be industrial staff. The West German government, which began dropping back to its level in 1950 two years after the initial East German exodus but with a larger population and forecasted basic to risk upon new employ about 70,000 workers in a number of plants.

The agreement with which the East German government felt it had to divert this talent to other channels, and a probable indicator of the financial pinch it is facing, is evidenced by the fact that it decided to bail out the Type 152 completely rather than follow the program through at least to the point of delivering the five months on hand or near completion to Deutsche Luftfahrt for use in prestige equipment on inter-continental flights in the West, presumably a major goal of the industry during its years of neo-socialist effort. Froying attests that the light test program could have been completed for approximately \$400,000 more.

Engineers' Fate

There apparently is no plan to outsize the industry, to its original role at aerospace within the next decade. A number of its engineers have remained or followed Froying to the West. Many have been assigned to bolster the truly relevant efforts of other basic industries at devoted at their posts to other tasks.

Donald Bunde, given official credit for design of the 152 and Froying's professor at technical director at Dresden is now in charge of a group of between 35 and 40 engineers engaged in the light design field in equipment completely divorced from aviation.

In the industry's prime Bunde, a former Jukov production engineer

who worked in the U.S. between 1929 and 1936, was heralded as the man primarily responsible for its premier rebirth. Its subsequent program also was credited largely to his efforts. He recruits birth, under technical from Froying and other Jukov colleagues who maintain that his greatest asset was his Communist Party membership and his ability to climb to party ranks.

Bunde," the German engineer now in the West says, "but the ability to merge into whomever or society he happens to be in. In Russia after the war, he was a Russian. Back in (East) Germany, he became a leading party figure. If he went out to China, however, he would become a Chinese."

After the crash of the first Type 152 prototype in the spring of 1959, Bunde was shifted to the post of director of research at Dresden, and Froying was assigned the most vital of technical director and chief designer. This was generally interpreted in the West as a slight to Bunde in a result of the accident. Froying and others, however, contend that the two events were not related.

Bunde, Froying and other German technicians returned into the Soviet orbit after being caught by the Russians elsewhere in the German heartland from the East in the summer of 1945—at the same time a number of their colleagues was being sent to the hands of the West. In the case of Froying, he was actually

seized to screen at his home in Dessau near the Jukov plant.

Then, in November 1945, Froying recalls eight armed Russian soldiers appeared one night at his home and proceeded to surround it. An interpreter asked Froying how much time he needed to get ready to move to the Soviet Union with his wife and two children—a son now 70, a daughter now 17.

"I said, oh, about two weeks. The interpreters said two hours."

And, within two hours they were on their way to the Dessau train station. Their belongings stuffed into two American automobiles which the Soviets had provided.

Froying's New Assignment

At the station they were seized aboard a train, also equipped with armed Soviet guards and began the journey to Russia that eventually landed them in the town of Podkorsky about 70 mi north of Moscow on the Volga Canal, the site of a former U.S. supplied machine production and development base. For security, the production facilities had been moved beyond the East-West border during the war, but the research facilities still remain, and Froying, working with both German and Russian engineers, was given the task of completing the development of an airborne fighter design for a six-engine, subsonic bomber designated the Type 151 by the Soviets.

Development of the aircraft, powered by six Junkers-designed Jumo engines of 7,415 lb thrust each, which had been redesignated the RD-10 by the Soviets was completed on a low-level bomber, and the Froying team worked to a design version of the 151 designated Type 114. Proposed proposals for the 151, however, were of Russian design—4,415 lb thrust Mikulin engines.

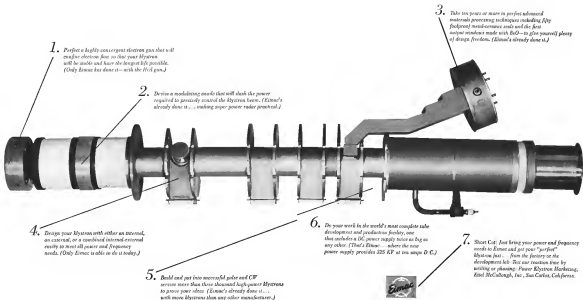
In all, Froying and his French remained in Russia until July, 1954, with his group working on a number of other designs, including a four-engine bomber begun in 1948, the Type 150, which remained in the experimental stage.

Froying began work on the Type 152



HALL 22, 379 ft in length, was one of two new assembly buildings erected at Dresden in support of the 152 and other transport designs

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Builders of the B-70 Valkyrie

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PROBLEMATIC RECREATIONS 80



Using mathematical symbols to modify four from 0 to 100 as well as millions of others. Example: 2 4/4 = 4/4 = 1/4. In this manner, strange four fours to equal these progressively more difficult numbers: 13, 19, 33, 65.

—Continued

Perhaps you were at the International Conference on Medical Electronics in New York last month. If so, you saw the Maltipack the new 3-channel biomedical amplifier-recorder from our Eastern Systems Division that makes possible simultaneous remote monitoring of three bioelectrical signals by telemetry, all in a unit about the size of a box of tissues. If not, you missed it. Better call our Computer Systems Laboratory for full details.

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The first development S-C 2000 console delivered to MTRC Corp.



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Douglas A-7D lands in and field with drag chute beginning to deploy and speed brakes extended. U.S. Navy completed a 91 week evaluation of three variants which are candidates to serve as an interim interim fighter until a proposed V/STOL tactical fighter with beam-riding nose is developed. Comparison of the nose and the appearance of the interim fighter (middle photo) in U.S. Navy markings raises the question of whether the interim fighter is to be operated by USN Tactical Air Command in the future.

Tactical Aircraft Evaluated for Interim Fighter Role



One of the two interim fighter A-7D strike fighters at the first three on a flight of four at it with power to taxi/roll from Navy's auxiliary field at Pensacola, Fla. (middle photo) with drag chute deployed lands at and field during tests.



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Package three legs to take shape in the Miss Mitsubishi Heavy Industries Nagoya factory as production of prototype YS-11 turboprop engines begins. Four prototypes are scheduled for completion by summer 1981.

Assembly Begins on Nihon YS-11 Turboprop Transport

Final assembly of Japanese-designed YS-11 turboprop transport is under way at Nagoya plant of Miss Mitsubishi Heavy Industries. Nihon Aircraft Manufacturing Co., Ltd., plans to have four prototype models completed by the summer of 1982 for test program. Nihon is a joint venture of the Japanese government and private aircraft manufacturing companies. The aircraft, designed as a replacement for DC-3 types, will carry up to 60 passengers (AW Dec. 28, 1980 p. 68). A total of 35 now are on order from All Nippon Airways, the Japanese Self-Defense Agency and the Japanese Maritime Safety Board. Imports have been received from 13 foreign nations. Nihon reported. Cost of each aircraft will be approximately \$2 million, excluding seats and equipment. The company tentatively plans to produce five models in 1983, 16 in 1984, 18 in 1985 and 24 each thereafter. Production will be 100-1500 per year (D&D 181).



Wing on left, (above, right) will have total area of 1,028 sq. ft. and an aspect ratio of 10.5. Aircraft is designed to carry up to 60 passengers, cruise at 157 kt at 20,000 ft and have a maximum range of 1,250 naut. mi with 5,400 lb payload.



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New Offerings

The Turbohyco Corp., Wilmington, D. C., acquired under Maryland law in December, 1962, for the general purpose of researching, developing, manufacturing and marketing air breathing engines, rocket propulsion engines, or gases which would be used in a variety of power plants for marine, ground, air, or space engines using open, enclosed sources for reactive propulsion in outer space and areas of product and technological development related thereto. To date, the company's activities have been entirely organizational; its patent business consists in perfecting a new type of gas turbine engine with a combined heat exchanger, said to be acquired, which is the invention of Dennis Freeman, a vice president for which patent applications have been filed and in which further extensive research and development are required. Offering is 200,000 shares of common stock, for public sale at \$2 per share. In the past the Freeman invention is developed partly by the company and in testing gas turbine manufacturers (those which negotiations are now in progress) the proceeds will be used for acquiring capital and research facilities and salaries, if the invention is developed without any such relationship or, as a result, the proceeds will be used principally for research and development activities as well as working capital.

Robert Senneker Research, Inc., Redwood, Calif., acquired under Connecticut law in May 1960, for the purpose of researching further and developing on a commercial basis certain methods, processes and ideas of Eugene C. Senneker, president and founder of M. Riken, vice president, related primarily to the fields of surface and low chemistry. The company is still in the precommercial and development stage and the methods, processes and ideas will require further research and refinement to establish their validity and to develop their commercial feasibility. The most fully developed of the processes which the company proposes to market commercially, is a process for the application of a bonded solid film layer onto or onto, container or sub-container parts. Offering is 150,000 shares of capital stock, for public sale at \$4 per share, offering to be made on or after next best offers have. Of the estimated proceeds, \$100,000 will be used for plant construction, additional facilities, production equipment, test instrumentation, all relative to the bonded solid film laboratory. \$441,100 for research and development, development of a sales organization and general working capital.



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"FORGING MILITARY SPACEPOWER"

USAF SYSTEMS COMMAND ISSUE

SEPTEMBER 25, 1961

On September 25, AVIATION WEEK and Space Technology will publish one of the most important issues in its history . . . "FORGING MILITARY SPACEPOWER" — USAF SYSTEMS COMMAND ISSUE. For the first time, the complete story of the newly activated USAF Systems Command will be presented to the aerospace industry throughout the world.

The new Systems Command will serve as a single agency to control R&D and procurement of all aircraft, missile, avionics and space systems for the USAF from the idea stage through the time they are in the field ready for use. This concept of a single agency for both systems R&D and systems procurement will have penetrating impact on all aerospace industry companies selling hardware or

research services to the Air Force.

The Systems Command will control approximately \$15 billion in contracts and annually will award \$7-8 billion in new contracts making it the most important single source of aerospace industry business. Further evidence of the impact on industry are policy and procedure changes which can be expected in many areas such as technical approach, contract competition, proposals, cost estimating, management structure and subcontracting.

These are just a few of the important details to be covered in the Systems Command Issue, which will constitute a new handbook in doing business with the Air Force. Teams of AVIATION WEEK editors are now visiting the various bases of the Command for full, complete reports. Detailed editorial coverage will be given to procurement, organization, plans and programs, policies, procedures and future technical activities.

AVIATION WEEK is privileged to present this edition to the industry covering our newest and vitally important Command. Prime contractors, subcontractors, suppliers and firms doing R&D work for the Air Force will be extremely interested in this new issue which will lay the groundwork for future contacts with the Command. It will supersede all previous editions on USAF research, development and procurement policies.

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U.S. Sailplane Market Potential Increasing

By Erwin J. Bellini

Wichita, Kan.—Growth of the U.S. sailplane movement is a potential market was apparent during the 28th annual soaring championships here Aug. 1-18. Major increases in the number of soaring enthusiasts, plus a noticeable sophistication in design of new sailplanes toward higher performance and growing acceptance of higher-powered rockets, portends that this is becoming a field of interesting potential for export and strong service operators as well as new electronics and other aircraft equipment suppliers.

Registration Increases

As a measure of the increased growth of the soaring movement, there has been an increase of 11,516 in national sailplane registrations in the last five years, a Federal Aviation Agency observer noted here to Aviation Week. And a member of the Kansas Soaring Association, which conducted the meet here, added that in that state he knew of no sailplane fly-ins any age—he estimated that today there were approximately 110 and the state organization has some 30 members.

Just as impressive was the expression of what this increase in interest is meaning in hard dollar volume terms in the top-ranking sailplane manufacturer in the United States, Schweizer Aircraft

Corp., Illinois, N.Y., which was founded in 1935 to build these improved aircraft.

Sailplane demand has developed to the point where this year the company had already built as many aircraft as it built in all of last year. Paul Schweizer stated and he expects that volume will continue so that the company should just about double the business it did last year, when it turned out between 30 and 35 airplanes. Higher than are that dollar volume, including the company's school, sales of literature and other allied sailplane operations will total some \$250,000 this year.

Production, which is now starting at about one complete sailplane every two days, including some military orders, is divided at approximately 90% on the two-place 2-11C and single-place 1-25 (described about evenly between these two models) with the remaining 10% being taken up by the single-place 1-21.

Initial Details

Initial details of a new high performance sailplane planned by the company for delivery next year were discussed briefly by Schweizer. The new model 2-12 is aimed at broadening the number of enthusiasts by making it possible for sailplane pilots to introduce the sport to friends and neighbors of their families at a higher performance level than the company's previous types B-

but the capability of being used as an advanced trainer for soaring and cross-country work and also may be used for competition, record and speed flights in the single and two-place categories.

The increased emphasis on several events for higher-performance is one of the important criteria considered in the basic design, Schweizer explained.

The design will be all-metal monocoque construction with wings and metal construction with aluminum and possibly some portion of the wings fabric covered. Skating will be tailless, with the rear passenger seated higher. There will be cruise zones for the pilot's feet that is the same model 2-25. The engine will be optional and the tail will be swept.

A prototype 2-12 now is under construction. The company plans to build out drawings on looking up for production until this fall.

Among the interesting new designs present during the meet here, indicative of attempts at sophistication which include increased design of new sailplanes, were National Champion Richard Schneider's HP 10 featuring a new wing ribbing consisting for the most part of metal monocoque construction and having a Kevlar plastic material leading edge. The Toledo, Ohio, pilot has plans to realize the HP-10 of 14 feet at a price of approximately \$5,500.

Design Highlight

The other new sailplane was Leonardo Neri's Sea—a \$18,000-class type in complete form of all-aluminum construction. A highlight of this design was the interesting approach in trailing edge flap—Sea utilizes trailing edge, cambered winging to achieve optimum cleanliness of the wing surface by eliminating gaps caused by conventional separate surfaces. This approach also considers simplifying construction by eliminating the need for building separate flap components and bracing them to the wing. This high-performance sailplane, which has a 35-cu-met volume, is designed at a glide ratio of approximately 45:1 and has achieved an average speed of 100 mph for over two hours in cross-country flights. Aviation Week was told.

Indications are that Sea now has about one model. Aircraft will be built in Arlington, Tex.

Foreign designs comprised a good percentage of the 35 airplanes attending the competition here—approx-



OSIMA 172 launches Cherokee II during practice session prior to National Soaring Association meet at Wichita, Kan. recently. Flight was made from Stratton Field near Wichita. 300 Thompson, Census chief of experimental flight test, is piloting two-place and Paul Wilson is piloting triplane. Census Aircraft paraded three B2's a 175 and a 172 as new records during the meet. The Census sailplane was able to tow gliders to a 2,000 ft. altitude in about five minutes time.

imately 10% of these present were imports, primarily German types.

Comments provided by these participants were pointed up by an industry participant who noted that one model, the K-30, costs approximately \$12,000, based at New York. With the five-year free living on metal covered some four in five times less than that of a monocoque. U.S. manufacturers, who he believed have made up their part from lost-it can make modern or comparable domestic product has even with cost and shipping costs.

Indications are, however, that there is little better pricing regarding this year differential at present the thinking is that the market potential is so large that these imports are not so necessary, however domestic producers and the low cost helps get interest which it is fully well in the future will displace. Indeed when the next year's higher performance type and wings toward metal construction.

Indications are that the rapid growth

of sailplane interest has caught the attention of the Federal Aviation Agency and that it has increased its attention regarding the movement. At least one FAA field man has been assigned to take a course in soaring at Schweizer Aircraft's school and the agency appears to be assigning additional people to cover the movement more closely. Some aviation observers feel that this should be done in future work on this part toward developing closer liaison with the FAA which may be helpful in development of future regulations that can be considered necessary in the subsequent growth to even larger proportions.

Airport Usage

A word indicates that the agency considers that sailplane pilots use a major group not produced in the fact that this meeting involved some 300 to hold in competition on late Wichita Municipal Airport, with some repetition fitting sailplane operations

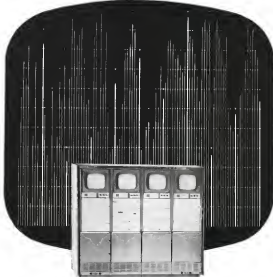
smoothly in with constant landings and takeoffs of planes and helicopters parked scheduled before flights. A field here was established on one side of the field which makes the sailplane pilots make their takeoffs and landings.

Participants at the meeting who could not recall a similar situation in the past wondered whether this persons could mark a significant indicator in soaring growth, reasoning that should such a program be extended to other areas it would have the dual benefit of providing more convenient facilities to hold better attended meetings due in same convenient location and previously to increased population centers. Additional public interest could be created and operators should find it easier to watch the competition and large audiences could be expected. Judging from the ownership of some participants, Census Aircraft which supplied late model 183's and a 172 and 175's two places, now has provided a demonstration of their ac-



Miller E4 Used to Fight Forest Fire

Miller E4 helicopter chutes for fighters in base in Sopchewick National Forest. Rotary wing craft carries three fire fighters, their equipment and pump dropping bags. The aircraft also could be fitted with a discharge water bag to make water drops for fire fighters. Helicopters stationed during the fire, was 6 in. per day, maximum allowed by the U.S. Forest Service.



THEY RELY ON RADIATION to place preflight data on display

The Raster Display System gives flight attendants a clear, constant visual display of vital data during remote checkouts. Its bar graph presentation of such variables as temperature, pressure and acceleration provides a quick indication of total system performance.

Radiation met the design challenge presented by Raster with an entirely new state-of-the-art approach to real time display. The system can present up to 400 channels of PCM data for visual interpretation with an accuracy greater than $\pm 1\%$. In addition, a demonstration and patch panel permits programming of incoming information to re-quant CRT's.

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capability for design and packaging of advanced electronic systems. It also makes a regular and consistent use of display systems for military and industrial applications. To learn how Radiation can help solve your advanced electronic problems, write for our "Capabilities Report."

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Sailplane Winners

Wichita, Kan.-hosting a *Genova* EO-70 sailplane A 1 Swift, Tracyville, Ark., won the 19th annual National Soaring Championships here. Swifts scored top finish third place in final on the final day of the meet by taking the final round on 19 mi. wind on from Wichita Municipal Airport in Sedan, Kan., averaged 40.2 mph. The final score tallied 4,564 points.

Second place went to William S. Jones, Jr., San Diego, Calif., flying a *Boeing Stear*, who averaged 40 mph in the final day's speed event to accumulate 4,147 points, bringing him up from fifth place. Second best speed in the event was 41 mph, made by Kai Dore, Haverhill, Mass., flying a *Genova* KA 06. His final point score was 4,218.

Third place in scoring went to Rudy Hermann, Richland, Wash., flying a *Genova* KA 06R with 4,194 points.

planes' capabilities in this area that could increase use of these types for this work.

At one meet official pointed out, local experience using the *Genova* has been very promising and the airplanes appeared to have low characteristics superior to some higher powered types, such as *Boeing* BT-13. The airplanes have good low speed characteristics permitting low climb without danger of exceeding the airplane's limitations, yet rate of climb is so good that rapid turnaround is possible. Cited as an example of turnaround was launch of 15 sailplanes here in 65 sec, which the observer thought probably constituted a record so far as a national meeting was concerned.

One Kansas local law officer has built a steady weekend and holiday business flying a *Genova* 151 as a sailplane tow, making approximately \$100 a day at five airports. Experience indicates that the 151 can provide a tow to 2,000 ft in 1/10 a backscatter hour and the airplane in actual operation has been providing 17 tows per hour-hour. At a rate of 55 per tow, more operation could make this a profitable venture in sailing, one observer felt.

PRIVATE LINES

Kennon Private Area, Inc. formed its own credit union which will have its headquarters in Wichita and has a potential membership, according to its representatives, of 500 people.

Ministry of Transport of Nigeria has purchased a *Comanche* C-440 from which will be used to transport govern-

ment officials in the African nation. Nigerian crew is being U.S.-trained.

Boeing B-200, two-engine, helicopter was delivered to Aero Kopter plant, Inc., Des Moines, Ind., recently. Boeings currently is producing 11 helicopters per month at the company's (Ft. Worth, Okla., plant).

Federal Aviation Agency Administrator

and N.E. Hilday, Sen. A.S. Monahan (D., Okla.) and Project Houseman Chairman Fred M. Glen will be featured speakers at National Business Aircraft Association's 19th Annual Meeting and Convention at Tulsa, Okla., Sept. 30-18. More than 50 manufacturers and convention firms have indicated that they will display their latest business aircraft at NEAA's event and flight demonstrations at Tulsa Municipal Airport.



Bristol Bulldog Restored

Bristol Bulldog fighter, pre-World War II Royal Air Force fighter will be presented to the Smithsonian Institution as Civil War-era aircraft was recently by Bristol Bulldog and the fighter's engine, being worked on from photographs, was rebuilt by Bristol-Bulldog Engines Ltd. fighter is Goshawk A-1, Bristol chief test pilot. The aircraft carries Bristol and registration markings.



New 10-place jet trainer

The Lockheed C-140 is a compact jet transport. It flies fast and high like jet fighters and interceptors—at just a fraction of their operating and maintenance cost. It can train an entire class of students for hours at a time, rather than one man for a few minutes. And students learn the fine art of operating radar and weapon control systems in tactical and strategic aircraft in a favorable environment, because the C-140's entire cabin is pressurized and air-conditioned. Students see the real thing on their radarscreens and instruments. The Lockheed C-140 also can stretch defense dollars when used for navigational aids checking, casualty evacuations, aerospace system flight testing, and for high priority cargo and passengers.

LOCKHEED GEORGIA



Lockheed Aircraft Corporation, Georgia Division, Marietta, Georgia.

PRODUCTION BRIEFING

Telecomping Corp's Advanced Structure Division, Mountain View, Calif., will produce bonded fuselage structure components totaling over \$100,000 for Amdahl's PU-1B program computers under contract from Bell Telephone.

Follow-on order for a number of Polaris Gert Mark 1 jet trainers has been placed by Royal Air Force Command due to start service with Young Training Command, is powered by the Bristol Siddeley Olympus 104 generating 4,270 lb thrust. Airframe replaces the Vamp T-11.

Magnet Corp. will supply solid-state exposure (SUE) turret system for a structural wind tunnel at National Aeronautics and Space Administration's Langley Research Center under a \$35,000 contract. Bennett will house two solid-state testing temperatures from 600° to a minimum of 2,000°.

Requirements study for a system that would detect or predict escapee situations in spacecraft and vent in three-wireable of a second to initiate escape will be made by Chance Vought Corp's Astronautics Division under a \$75,000 contract from USAF's Astronautical Systems Division. One requirement is that the system signal the astronaut or ground controller of escapee danger and automatically initiate corrective measures to evacuate the crew from parachute through the egress light.

Northrop Corp's Naval Division, Hawthorne, Calif., has received a \$79,800 Air Force contract to study systems for spaceflights. Receipt of the oneway contract came after a two-way computer-aided research program on systems.

Ryan Aeronautical Co's Aerospace Division, San Diego, Calif., has been awarded a \$155,000 contract to provide specialized personnel and services for construction of Amdahl's Fusion ground launchings at White Sands Missile Range, N.M. The contract also calls for three Model 124-E Fimbres, a special Amdahl configuration of the Ryan Q-3C.

Modifications of the TIVNA aircraft model will be performed by the Good Year Aircraft Corp. under a \$3,137,190 contract awarded by the Air Force. Included in the improvements being installed is a rapid fire multiple launch system.

Amper Corp. has received a \$1,436,360 contract from Navy Bureau of Ships for production of T14 two-channel, three-speed magnetic tape recorder/processors.



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	R9608-001	R9608-002
Output (Volts/100 rpm)	1.0 (typical) 0.50 (minimum)	2
Rated Speed (rpm)	3600	5000
Linearity	7% to 3600 rpm	.1
Winding Resistance (ohms)	125	
Output Impedance (ohms)	—	36
Applied Voltage	2% above 360 rpm	2.5% of 3600 rpm
Friction Torque (in-oz)	0.25	0.15
Motor Moment of Inertia (gm-cm ²)	2	8
Weight (oz)	5.5	5

Write for complete data



**KEARFOOT DIVISION
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Little Falls, New Jersey

NEW AEROSPACE PRODUCTS



Pressure Pilot-Controller Starts A3J

Pressure pilot-controller permits reduction of pilot compressed air for starting jet engines. The device is shown starting a Navy A3J attack aircraft at North American Aerospace. The pressure pilot-controller permits the use of pilot compressed air by regulating air pressure as it is used to start jet engines. This is the maximum pressure allowable in starting the A3J's General Electric T9 turbojet engines. The pressure of the regulator unit is 54.900. It is made by U. S. Gauge Division, American Machine and Metals, Inc., Schenectady, Pa.



Integrated Flight Indicator

Low cost integrated flight instrument various for private and business aircraft combines VORLOC course deviation indicator and glide slope indicator with the gyro horizon.

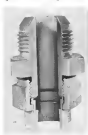
Based on patented Sperry-invented gyro, the indicators are available in two models: Model 1, priced at \$1,078 contains a VORLOC and horizon indicator. Model 2, costing \$1,192 adds a glide slope bar, flag alarm and external red lighting to the instrument. Meter portion of the units meets ARINC standards (1,800 ohm, meter movement) and the signals to the pilot instrument were supplied by a Narco controller.

Forest City Aviation Service, Inc., 749 Congress St., Portland, Me.

Tube Coupling

Pressure-rated tube fitting is designed to reduce leaks in high performance lines of rocket and turbine engines and general support equipment.

The O-rings coupling contains liquids or gases through a hose in a pressure range of -60 to 4,700 psi, cryogenic and 1,900° Fahrenheit will be available. The coupling is said to be up to 60% lighter than flared fittings and is leak-



proof at pressures handling the stainless steel tubing. A ball seal over a heated torque ring virtually eliminates the need for torque wrench installation, designed for rigid tubing or high pressure. Teflon hose applications, the fittings are produced in -2 to -24 sizes with larger diameters available on special order. Bessette Corp., Roseland, N. J.

Helicopter Sling

Nylon web helicopter lift sling, in production for the Adams Corp., has a working capacity of five tons.

Each of the four nylon webbing legs will support 10,000 lb and the nylon lift ring will support 40,000 lb. A modified 10,000 lb. rubber buckle permits adjustment of each leg individually. The lift ring is bolted together



permitting it to be changed in the field without sewing. The sling assembly, made up of nylon webbing 12 in. wide, weighs less than 30 lb.

General Logistics Division, Aerospace Corp., 2929 Floyd St., Burbank.



Steel Baggage Conveyor

Baggage conveyor built at Maxfield's Dorset Airport is made of 24 in. wide steel belt.

The .012-in.-thick steel belt is expected to withstand conventional loading and its smooth surface permits easy removal of baggage. Two V-rings housed to the underside of the 75-ft.-long belt run in grooved drums in the conveyor terminals to provide continuous free tracking.

Sand & Stock, Inc., 1792 Nevins Rd., Erie, Pa.



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grounded of the DC-3. The time of that 15 min. before the accident the aircraft could have been over an area about 11 mi. southwest of Rochelle's coordinates.

The second phase of this work was a series of action plots from the Cassinians' track as the elapsed time between the Cassinians and Rochelle's reports. It was determined that the flight would have flown 10 mi. A line of position with a radius of 11 mi. from Cassinians was found to intersect the initial plot at a location which was approximately 15 mi. from the crash site again about 15 mi. southwest of Rochelle.

At the completion of this work two additional significant features were apparent. The point of intersection of the plots was directly coincident with the 114 deg. radial of Condorville. Secondly, the heading to the location of intersecting plots from Cassinians was the 260 deg. radial of Cassinians and the time in the assumed failed to Contact from Springfield.

Captain's Duties

At Cassinians' Condorville flight made the previous report and most probably occurred it as the flight plan was being followed. Therefore he could be expected to have his eyes set on the Condorville frequency when on the 114 deg. radial in order to identify the Rochelle's aircraft. Considering the small amount of time elapsed at this time, this last action could have been a distraction for the period during which the capture would normally have made the turn. Turning his eyes to Condorville, though necessary, would also have the opportunity to observe he was indicating the relative position of the aircraft to the scene of the crash. Additionally there are indications that Capt. Levine had made a lower than average level of instrument panel clearance time. In the Board's opinion these factors are valid reasons in this instance for the cockpit not having detected the winged aircraft.

After reporting Rochelle and turning to his radio on heading at a little bit, both pilots believed the aircraft was describing a pronounced turn of left only a short distance west of the second track from Rochelle to the Charlottesville tower. It is the Board's opinion that at this time the flight was, in fact, 11 mi. southwest of Rochelle. While this position was only two to three miles farther than Rochelle from the Cassinians' origin, the position placed the cockpit out of range of its flight right to nine miles west of the reported track. The location also positioned the flight about 10 mi. further from the tower facilities than from the Rochelle's intersection.

It is believed that this latter factor could not be observed the lateral error which moved during the southwest portion of the flight. The greater distance from the spiral source would reduce the angular displacement of the ADF procedure. Thus, if the aircraft was positioned 10 mi. further from the spiral source than it was believed to be, its pilots, the angular deflection of the ADF procedure could be the lateral error even could be observed immediately by the greater distance. For example, the ADF procedure 14 mi. from the spiral source and right to nine miles west of track is not distinctly different

from the procedure 12 mi. from the spiral source and three miles west of the procedure track. Similarly, the ADF procedure 10 mi. from the spiral source and right to nine miles west of track is not distinctly different than the procedure from nine miles from the spiral source and three miles west of the track desired. In addition, as the flight progressed toward the facilities but from a greater distance than believed by the pilots, the increasing angle displacement of the ADF needles showing lateral error could be interpreted as a closure on the spiral source. The Board believes the foregoing statement is to be a valid consideration in the sense that the pilots were not alerted only in the approach to the large lateral track error.

On the other hand, the Board is aware that as the flight continued on the south-west course the rate of progression of the ADF needles to the left 90 deg. shown in flight would have been much closer in the south of the greater distance and time to be flown. At the 114 deg. position the angular spread between the needles would have been much narrower, 5 to 10 mi. west of the location than three to four miles west of the location. Further, 90 deg. ahead of the spiral source a 204 deg. relative bearing distance on a flight path due to four miles west of the location, would trip 30 to 40 mi. as contrasted to approximately 14 mi. on a flight path about nine miles west of the tower. In addition, the ADF procedure during the period the flight turned from the southwest heading and it struck the maximum would have been impossible with an attitude pilot that the lateral course due to use of reasonable airports.

Thus, the course of the investigation the aeromedical history of Capt. Levine was reviewed. His training, qualifications, and professional aspects were satisfactory. His behavior showed that he had progressed normally to retirement and had served in that capacity since May, 1957. It was noted that he had had three or four years of Charlottesville and over the past several years he had served on a regular basis. Capt. Levine had flown a total of 5,248 hr., of which 4,571 was in DC-3 aircraft.

To the Board there were numerous factors which were obviously inconsistent with Capt. Levine's record. Some were the apparent perceptual impairment, a mild disturbance to severe hearing problems, and a distinct belief the unaided procedure was adequate. Other were the failure to detect the turn for nine miles west to seven of that momentary with a clear position, and that ADF action from were not compatible with the visual measures when procedure. Still others were a failure to report the latest Charlottesville weather when the communication did not break it, and not using the altimeter setting as a result to fix on target report. The Board believes these factors were not only associated with Capt. Levine's position in an existing pilot but were indicators of a recent degradation in the high standard and quality of performance expected during an instrument operation. Because of these factors a complete history investigation was made into the personal background of Capt. Levine. This

work in the fields of this future of NAA.



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